BRITISH BATTLE TANKS

SIMON
DUNSTAN

POST-WAR TANKS 1946–2016

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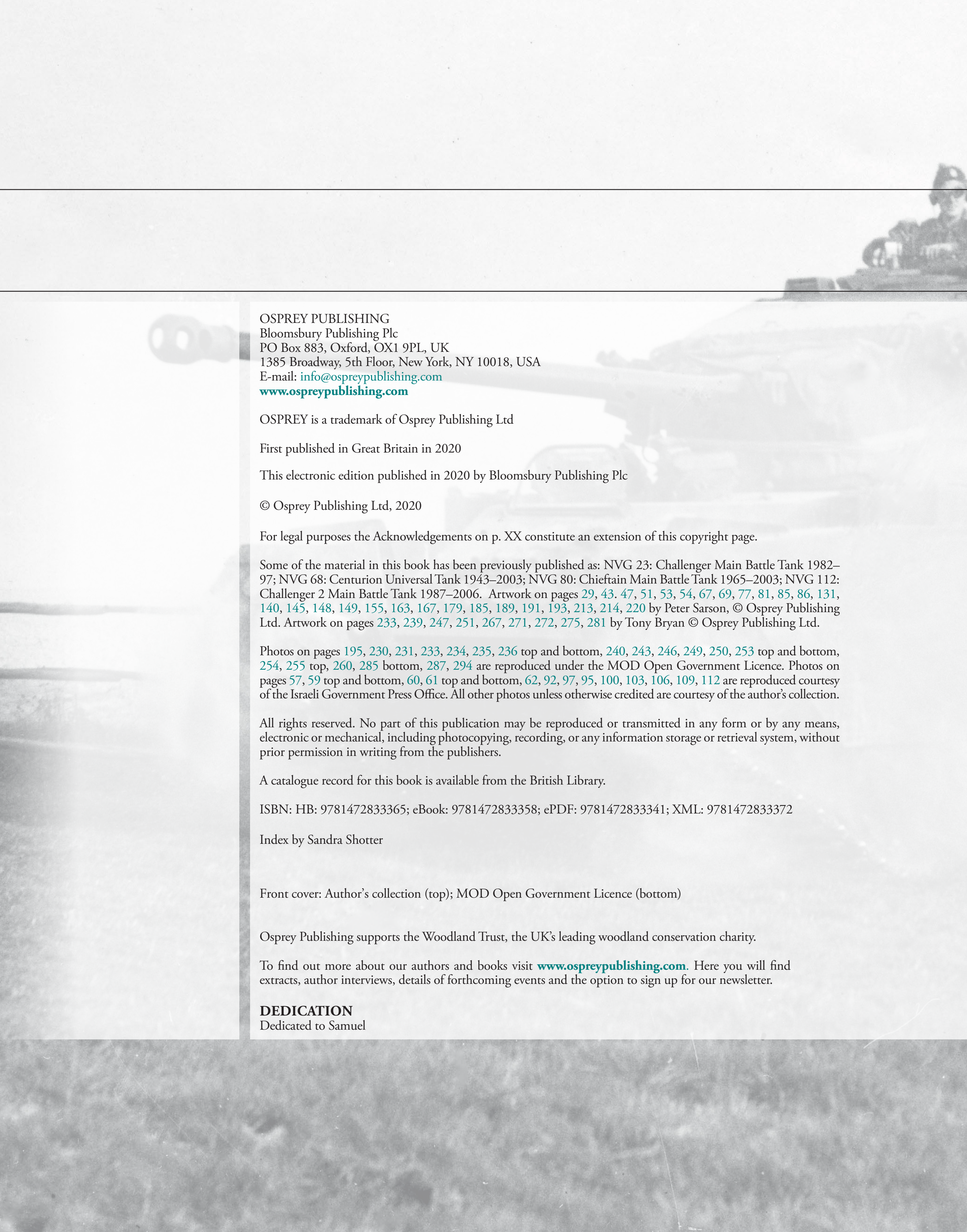

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DEDICATION
Dedicated to Samuel

CONTENTS

FOREWORD 4

INTRODUCTION 6

Chapter 1. **CENTURION** **10**

Chapter 2. **VICKERS BATTLE TANKS** **114**

Chapter 3. **CHIEFTAIN** **128**

Chapter 4. **CHALLENGER** **174**

Chapter 5. **CHALLENGER 2** **226**

AUTHOR'S ACKNOWLEDGEMENTS 291

INDEX 296

FOREWORD

BY MAJOR GENERAL PATRICK CORDINGLEY DSO OBE D.Sc. FRGS

As a cavalryman, it has always intrigued me that the British should twice in their history have produced the weapon that diminished and finally eliminated the role of the horse on the battlefield. At Crecy, Poitiers and Agincourt, English archers caused slaughter among the French mounted knights; then gunpowder superseded the longbow on the battlefield. During World War I, at the Somme, Cambrai and Amiens, the appearance of the tank consigned cavalry to history.

In the 1930s, the British Army successfully undertook the transition to mechanization but tragically did not have sufficient tanks to create a coherent armoured doctrine to thwart the Blitzkrieg tactics of the German Panzers during the campaigns in France and North Africa. In the early war years, British tanks were woefully lacking in firepower, armour protection and reliability until the arrival of the American Sherman medium tank in 1942. Warfare in North-West Europe in 1944–45 was determined by the mass of materiel from West and East leading to the defeat of Nazi Germany. Nevertheless, there emerged a tank that was to epitomise the very ethos of British tank design after six years of bitter conflict.

Centurion served the British Army with distinction and was the progenitor of the main battle tank concept, which emerged with Chieftain and its powerful L11 120mm main armament. Thereafter the British adopted a policy of evolution rather than revolution with Challenger and Challenger 2, which fought in two Gulf Wars. On both occasions the British concept of tank design, with the emphasis on armour protection and firepower over high-speed mobility, was successful in the particular circumstances that prevailed.

Within days of arriving in Saudi Arabia with the 7th Armoured Brigade Group in October 1990, I decided to command it from a tank. My Challenger was crewed by members of the Royal Scots Dragoons Guards and a Royal Anglian officer, and we named it 'Bazoft's Revenge'. For nearly six months, I lived, worked and slept either in or near to the tank. It became a reliable friend but I cannot ever claim it was comfortable.

On 25 February 1991, we crossed the line of departure into Iraq leading the US VII Corps, the largest Corps in the history of warfare. It was a cold overcast day and we were nervous because none of us had done such a thing before. But we felt confident in our tanks and this was not misplaced. Challenger was exceptional. Its firepower was devastating, with enemy tanks quite commonly being destroyed at 3,000m range. We advanced 302km in four days and destroyed some 350 Iraqi tanks and APCs. As we arrived north of Kuwait City 92 per cent of my 117 Challengers were fully fit – and that figure is remarkable. I am proud that I lived for six months and then fought for a brief time in my tank. I always thought that Challenger was built for war and not competitions.

This volume by Simon Dunstan describes in considerable detail the design route from Centurion to Challenger 2. Despite serving for many years in Chieftain, being involved with the termination of MBT 80 and then the requirement for Challenger 1, I learnt fascinating aspects about these 'workhorses' of the Royal Armoured Corps. The stories of their deployments in wars since 1945 are also remarkable. They have fought with the British Army in Korea, Suez, the Rafan, Kuwait and Iraq. With other armies they have been used extremely successfully in the Indo-Pakistan Wars, the Arab-Israeli Wars, in Vietnam with the Australians and in Angola by the South Africans. Their stories are told here by many of the participants in a truly engrossing way. This excellent and most readable volume makes one feel proud of our tanks and their designers and above all of the men who served in them.

As Colonel Commandant of The Royal Dragoon Guards, Major General Patrick Cordingley poses in front of a Chieftain Mark 5C with a Guard of Honour and the Regimental Colours.

INTRODUCTION

BY MAJOR GENERAL SIR LAURENCE NEW CB CBE

I first met Simon Dunstan on 16 February 1978, when I was Colonel (OR) 17 in Whitehall. At the time he was undertaking research into the Centurion tank for an excellent book that was published in 1980. To this day, it remains the standard reference on that exceptional British tank. It is thus some 41 years almost to the day as I write the introduction to this thoroughly researched book on British battle tanks since 1945. I identify with it closely, having been intimately involved with the events and tanks described for most of the years from 1952 to 1985; latterly as Assistant Chief of the Defence Staff (Operational Requirements) Land Systems and as a Colonel Commandant Royal Tank Regiment from 1986 to 1992. It was axiomatic that the failures of British tank designs during World War II, of inferior firepower and inadequate armour protection, would not be repeated in any British post-war tank.

This review of the development of our main battle tanks from Centurion to Challenger pinpoints many of our successes and equally some failures. The former explains our achievements in battle, notably in the Gulf; the latter go some way to explaining our poor showing in international competitions and our failure recently to sell our tanks abroad, while the German Leopard 1 and 2 have been sold to numerous nations. By contrast Chieftain, despite its excellent protection, firepower and cross-country mobility, was sold to just six nations, the principal reason being its mechanical unreliability. The inclusion of an untried and inadequately developed horizontally-opposed two-stroke multi-fuel L60 powertrain was disastrous. In August 1968, I was stationed in Germany as Brigade Major of 20 Armoured Brigade. We had three armoured regiments including the recently amalgamated Blues and Royals that was the only one equipped with Chieftain. On their first foray to the Soltau Training Area they suffered the breakdown of 40 tanks in ten days, eventually leaving only three operational. If it was not cylinder liners, piston failure, overheating of the TN12 gearbox or failing air cleaners, it was something as simple as stripping fan belts. In 1972, as the CO of 4 Royal Tank Regiment, I commanded the first Battle Group to train on the extensive BATUS live firing and manoeuvre training area in Canada. The sick joke emerging from the subsequent Medicine Hat exercises was that they were not so much to benefit armoured battle group training as for the REME to refine their sustenance of Chieftain.

A tank must have a balance of protection, firepower and mobility, but none of these qualities matter if it does not also have availability. Mechanical unreliability, as Simon makes clear, has been our Achilles heel for most of the period under review. It was not always so; we produced some 4,423 Centurions in the years 1946 to 1962, with almost half being sold to the USA, Australia, Canada, India, South Africa, Sweden, Switzerland, Egypt, Iraq, Jordan, Kuwait, New Zealand and most notably Israel. One of the additional features of Simon's book is his explicit description of how the Centurions sold to Israel were upgraded into their spectacularly successful Shot Cal. In 1973 these tanks enabled the IDF to defeat a Syrian armada on the Golan Heights equipped with some 1,200 Soviet-made main battle tanks, including the latest T-62. Initially there were some 50 Syrian tanks for every Shot Cal and at no stage less than 15 to one. I spent three years in Israel as Defence Attaché immediately after the Yom Kippur War and I can assert with some authority that Simon's explanation of those extraordinary events is the most comprehensive in print. The IDF enhancement of these Centurions, reminiscent of the Soviet practice of making incremental improvements, is surely worthy of this study.

Fundamental to the IDF success on the battlefield was the standard of gunnery within the Israeli Armoured Corps; a legacy of General Israel Tal. This superiority was in large part due to the superlative L7 105mm gun that was one of Britain's finest contributions to armoured warfare in the late 20th century. Indeed, the 105mm gun remains in frontline service to this day; some 60 years after its introduction. Another was the development of Chobham armour that has markedly improved survivability of MBTs on the battlefield. The lead engineer on that project was Julian Walker at MVEE whom I had got to know and he impressed me greatly. However, the FV4030/4 Shir 2 did not meet the General Staff Requirement for our new main battle tank, notably in protection and reliability, both being thought to be capable of enhancement. In the event they remained a weakness in Challenger 1 but were solved in Challenger 2. Commercially it would provide employment for the Royal Ordnance Factories which had lost the Shir contract through no fault of their own. There was significant reluctance to abandon years of work on MBT-80 and there was an informal lobby within the Royal Armoured Corps to purchase Leopard 2. We in OR

From the 1960s onwards, the Royal Armoured Corps retained its faith in the concept of rifled tank guns in the belief that they could fire a wider range of ammunition than smoothbore weapons. In particular, the British favoured the High Explosive Squash Head (HESH) round that remains a highly effective battlefield HE projectile against troops in the open and under cover; field fortifications; soft-skinnned targets; as well as having a useful capability against AFVs. Here, a Challenger 2 MBT of 1st Royal Tank Regiment engages targets during a Firepower Demonstration on Salisbury Plain in April 2009: the Chinese Eye symbol on the turret side originated in the Great War and became the insignia of 4th Royal Tank Regiment: the regiment commanded by Lt Col (later Maj Gen) Laurence New

17 and the RAC hierarchy were against the foreign buy for predictable reasons, not least that we would have lost the British L11 120mm rifled gun which optimised a HESH round and had a higher chance of a kill at longer range than the smoothbore-type gun fitted to German and American MBTs. The government was against a foreign buy for commercial and 'national' reasons. The hitherto time-consuming insistence that we should work with our allies to produce a multi-national tank was mercifully abandoned because the Americans, French and the Germans were now beyond that point in their MBT development cycle. Very significantly the brilliant Master General of the Ordnance, General Sir Hugh Beach, (in effect the military Head of Procurement) could see how a tank based on Shir 2, but heavily modified, could be procured effectively and speedily. The decision was taken in July 1979 to commit to the newly named Challenger programme. Even so, both the Americans and Germans fielded an MBT protected by a variation of Chobham armour before the British Army.

One of my lasting memories was the acquisition of thermal imaging or TI for Challenger. Over the years, Royal Tank Regiment has produced several technical geniuses such as Major Ralph Bagnall-Wild who was the guru on gun control systems. In the summer of 1978, we were comparing the GSR for MBT 80 with that for Shir/Challenger. Ralph had by then been lured from the Army by the leading optical manufacturer, Barr & Stroud. One evening we both happened to be at Bovington at HQ DRAC for a planning meeting. At that stage almost all night-vision equipment relied on image-intensification technology and we were committed to that for MBT 80. Ralph asked me to see a project that he was working on; he had set up a demonstration model on the roof of the building to demonstrate his idea of a thermal imager incorporated into the gun sight. It was very impressive, and I recall dragging DRAC out of his office to come up and see it. The cost would be huge but it was so superior that we persuaded DRAC there and then to put his weight behind it. To cut a long story short, once we had come to terms with the likely cost it was included in our stated requirement for Challenger and in due course became the Thermal Observation and Gunnery System or TOGS.

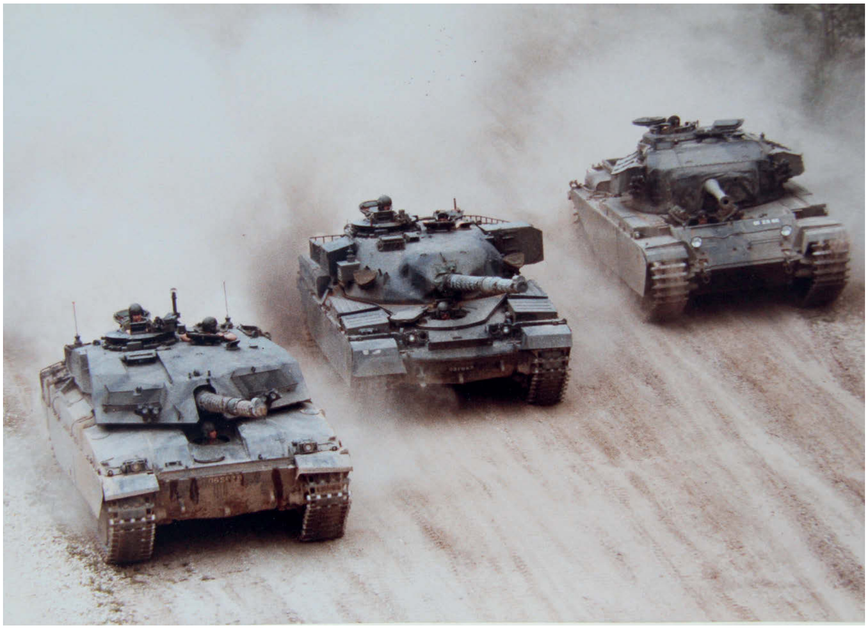
In December 1982, I was promoted to major general and went back to the fraught world of operational requirements as ACGS (OR) and later ACDS (OR) Land Systems. It was said to be one of the most grindingly difficult jobs in the MOD, with a budget that was ever-decreasing and an imposition to talk constantly with our allies, especially the French, Germans and Americans, in the pious belief that we could thereby secure economies of scale. The irony for me personally was that I was confronted inter alia by each of the programmes I had struggled with as Colonel (OR) 17. Challenger was brought into service in 1983 prematurely, following a dangerously brief trials programme and consequently suffered some unreliability problems, compounded by insufficient spares backing. It had a good power-to-weight ratio derived from its Rolls-Royce Condor CV12 TCA turbocharged diesel engine, developing 1,200hp. It also had significant improvement in protection from its Chobham armour. It had the extremely accurate L11A5 rifled gun with an excellent laser rangefinder giving a high first-round chance of a kill with APFSDS ammunition out to well over 3,000m and a very effective HESH round out to 5,000m. During Operation Granby a Challenger destroyed a Russian-built tank at 4,100m. Only 420 Challengers were built and it was phased out of service in 2000.

Its successor Challenger 2 was procured in even fewer numbers, yet it represents the culmination of British tank design, a lineage that stretches from the first Mark Is that lumbered into battle on 15 September 1916 during the battle of the Somme until today. Like its forebear the Centurion, Challenger 2 has combined the essential attributes of any tank – firepower, protection, mobility and reliability – to an exceptional degree. Tragically, it is the last main battle tank to be definitively designed and manufactured to the specific requirements of the British Army. Tragically, because there is no longer a tank industry in the United Kingdom, we are now beholden to foreign suppliers for any future battle tank for our armed forces.

We owe a debt of gratitude to the teams, military and civilian, who have been involved in the hugely complex process of the procurement of AFVs for the British Army. As Simon Dunstan recounts in this splendid history of British battle tanks since World War II, it is testimony to the versatility of those British tank designs that they have more often fought in sand-coloured camouflage than the green-and-black adopted for high-intensity warfare in North West Europe within NATO. Beyond the peculiar circumstances of the Korean War, British post-war tanks have gone to battle in the Suez Canal zone; the Indo-Pakistan wars of 1965 and 1971; the Arab-Israeli wars of 1967, 1973 and the Lebanon; with the Australians in Vietnam; the Iran-Iraq War; in Angola; and the Gulf War of 1991 and Iraq 2003. It is a remarkable record that no other Western tank-producing nation can emulate.

Throughout my military career, there have been repeated clarion calls that the tank is dead due to the emergence of numerous anti-armour weapons, from the bazooka to the attack helicopter. Yet apart from the battle tank, what other weapon system can negotiate broken ground while delivering devastating direct fire in support of other arms while protecting its crew against enemy fire? In the 70 years covered by this history, fewer than a dozen tank crewmen of the Royal Armoured Corps have been killed by enemy action in the tanks described in this impressive book. Should we again be called to take part in another high-intensity all-arms close-quarter battle we shall be reminded most forcefully of the crucial need for such a weapon system. Let us hope it will not be too late.

FEAR NAUGHT



Three generations of British battle tanks thunder down a track at the Long Valley proving ground in 1982, showing the evolutionary development of MBTs from Centurion via Chieftain to Challenger.

CHAPTER 1

CENTURION

PROLOGUE: BLACK BESS ON THE HOOK

The 5th Royal Inniskilling Dragoon Guards (5 INNIS DG) deployed to Korea in late 1951. As the armoured regiment assigned to the 1st Commonwealth Division, the '5th Skins' replaced the 8th King's Royal Irish Hussars who had won lasting fame at the battle of the Imjin River in April 1951. By the time the regiment arrived in Korea, the war had become static with the opposing armies deeply entrenched on barren hills that stretched from coast to coast across the devastated peninsula while protracted political negotiations were conducted to bring an end to the war. In the meantime, hostilities continued, with the tanks positioned on commanding heights to provide direct fire support to the infantry.

In general, a single squadron of tanks supported a brigade of infantry, thus two squadrons were in the line at any one time since the Canadian brigade was supported by its own armoured formation – Lord Strathcona's Horse (Royal Canadians) (2nd Armoured Regiment) equipped with M4A3(76)W HVSS Sherman tanks. The 5th Skins were equipped with the Centurion Mark 3 that had gained an enviable reputation for its hill-climbing abilities and the formidable accuracy of its 20-pdr main armament. During the course of 1952, the regiment conducted a number of armoured raids into enemy territory, but the results rarely justified the expenditure in resources. Thereafter, the tanks remained in their hilltop revetments dominating no-man's-land by day and providing intimate fire support to infantry fighting patrols at night; often within 25 yards of friendly troops.

On the night of 18/19 November 1952, 4 Troop B Squadron was in support of the 1st Battalion The Black Watch commanded by Lieutenant Colonel David Rose. The troop of four Centurion Mark 3 tanks under the command of Lieutenant Michael Anstice was split into two halves, comprising Callsigns Four and Four Baker together with Four Able and Four Charlie. Both were sited on Point 121 beside C Company, with a fifth tank, Callsign One Dog, capable of firing in support located east of the Samichon River. Behind the troop position were ammunition bunkers and underground 'hutchies' or 'bashas' to protect the tank crews from artillery fire when not inside their vehicles. The task of the troop was to provide defensive fire on enemy forming-up positions and on the spur feature known as Ronson that was one of the main approach routes to the Hook.

Prior to the battle, it had been established that a tank could be driven to the top of the Hook in daylight but the track was narrow with a precipitous drop to one side

In the peculiar circumstances of static warfare in Korea, tanks were perched on the tops of hills to engage enemy positions by day or night in support of the infantry companies on the frontlines.

that allowed no room for manoeuvre. In fact, when trying to get his Centurion to the top Lieutenant Anstice shed a track on the difficult terrain and was shelled whilst repairs were undertaken. As Lieutenant Anstice stated: 'There was doubt as to whether a Centurion tank could manage such a climb on such a narrow track cut into the side of the hill. We tried in daylight, lost a track and retired having replaced the track under shellfire. Exercise over or so we thought.'

At 2100hrs, heavy shelling fell on the Hook and the tank positions followed by a ground attack from Ronson and Warsaw against A Company on the summit of the Hook. Using their searchlights, 4 Troop returned fire on Ronson but the smoke of battle was such that no enemy could be seen. Lieutenant Anstice recalled:

> On the evening of the 18 November 1952 I was sitting on the turret of my tank BLACK BESS [Callsign Four] enjoying a can of self-heating oxtail soup when the ground erupted all around me. I remember saying 'This is it!', jumped inside the tank closing down as I did so. The Chinese barrage was intense and largely directed at us. They feared the Centurion with good reason. We started firing on fixed lines with our secondary armament using the illumination of our searchlights. These lights proved useless in action as they reflected off the smoke from our own guns. It was but a short time before they were destroyed by enemy shellfire as we were hit many times by Chinese artillery with the trackguards and bins shot off.

Trooper Brindley in Callsign Four Charlie recalled:

> 4 Troop were sitting it out with the Black Watch just behind the skyline in our dug-out with a wireless extension from Centurion Four Charlie and we soon realized we were for it. Running the few yards to our tank we survived many mortar bombs bursting among us and we were soon on the move, myself driving with headlights on and still unaware if small arms directed at us was from our lads or the Chinese. We received many Tokyos [direct hits] – just like being in a bell.

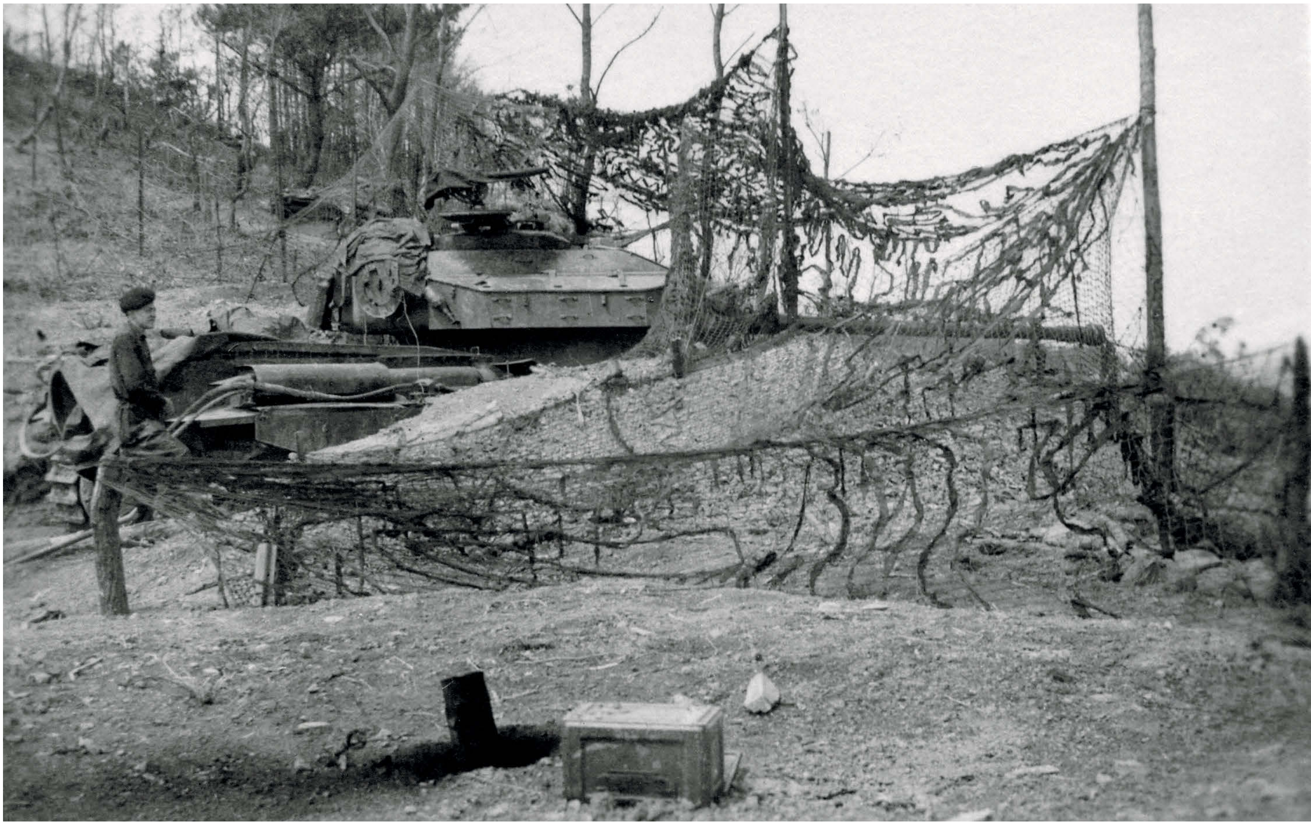
Inside Callsign Four the crew were suffering as Lieutenant Anstice continued:

> Due to being closed down the fumes in the turret were excessive and the auxiliary generator extraction fan could not cope with the gas generated by both the main armament and coaxial machine gun. I was violently ill and my loader-operator [Trooper Bob 'Ollie' Scot] rendered unconscious. I sent for a replacement and Corporal [Peter] Williamson was brought out by jeep from squadron headquarters.

Lance Corporal Peter Williamson takes up the story:

> Up till 2100hrs I had been on duty in the Gin Palace [squadron headquarters radio truck]. I knew it was going to be a long night and that I would have to be back on duty by 0100hrs. After a quick drink I hit the sack. I was soon woken and told to report to the squadron leader. He told me the radio-operator in 4 Troop leader's tank, a Trooper Bob Scott, had been overcome by fumes and that I was to take his place. The squadron leader's jeep was waiting for me but in my hurry I left my cigarettes behind though I did have my Sten gun. By the time I reached 4 Troop they had finished replenishing and had gone back up the line under the command of the troop sergeant, Sergeant Bob Nunn. Only the troop leader's tank was there. As soon as I climbed aboard and began firing I could see why Trooper Scot had collapsed. The fumes in the tank were terrible when closed down. The extractor fan was useless and as radio operator I had to stand over the Besa machine gun to put in new belts of ammunition and to clear any stoppages.

A Centurion Mark 3 of 5th Royal Inniskilling Dragoon Guards is dug-in on the skyline on Point 355 or 'Little Gibraltar' with the tracks and suspension protected with earthworks against enemy artillery fire.



Lieutenant Anstice related:

> By this time the Chinese had overrun Ronson and Warsaw and were clambering on to Hook. The Black Watch retreated into their tunnels and the divisional artillery decimated the Chinese caught in the open. They were driven off taking their dead and wounded with them.

During the initial clash both the Chinese and Allied artillery were bombarding the Hook; the latter concentrating on the ground between both Ronson and Warsaw and the Hook. The Black Watch had in the meantime gone to ground in a series of tunnels they had dug into the hillsides leading off from their communications trenches: an effective tactic against massed artillery bombardment copied from the Chinese. The heavy fighting continued until approximately 2145hrs when the enemy attacked in great force and occupied the A Company position. At 2150hrs, an Uncle Target was unleashed on the Hook by the complete divisional artillery, supported by American heavy weapons, with devastating effect and the Hook was reported clear of the enemy at 2225hrs. Lieutenant Anstice recalled:

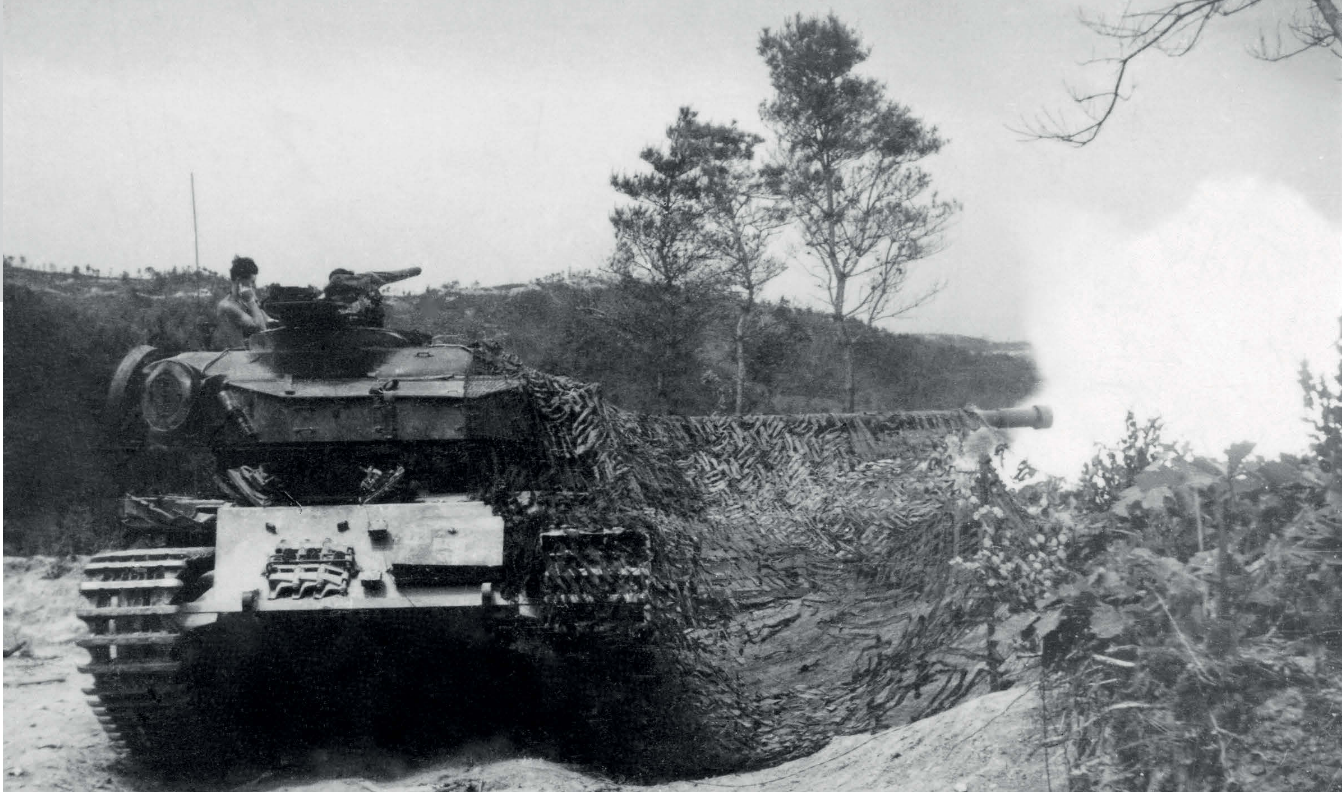
> There then ensued a brief lull until the fun started again. We had got through a lot of ammunition and withdrew to replenish. Once again the Chinese attacked from Warsaw and Ronson. There were no longer any outposts to hold up the attack and the enemy were once again on the Hook. It was at this stage in the battle that Colonel Rose asked for a tank to lead a counterattack.

The Black Watch plan was for the tank to climb on to the Hook and then form the centre of a counterattack by A Company along the top of the ridge. The Regimental Signals Officer of the Black Watch, Lieutenant David Arbuthnott, was in charge of all communications within the battalion. He was in direct contact with both the supporting artillery and the tanks:

> When you get into battle people like the artillery are vital and we were incredibly lucky with the support we got from them. It was almost instantaneous when you wanted it and able to switch around wherever it was needed and it produced an enormous number of shells on one piece of ground if there's a crisis. The tanks were used very strangely in Korea. Normally you think of tanks in large numbers dashing across the desert with dust flying. Because it was a completely static war the tanks were used as long-range snipers. They climbed up on to the hills and then with their 20-pdrs which were incredibly accurate, they could shoot straight through the aperture of an observation post. The other thing was they had very powerful searchlights so at night they would switch them on and we could see what was happening in front of us. It wasn't their kind of war but it was good for us.

The troop leader lodged a protest since the plan seemed highly impractical as Lieutenant Anstice attested:

> I had already tried and failed to get up the Hook in the daylight rehearsal losing a track in the process. Tanks are highly vulnerable at night and normally form close leaguers and only sally forth at dawn. They do not drive blind into enemy infantry. I objected to the order [to Major Bill Garnet, OC B Squadron 5 INNIS DG] on the grounds that we probably would fail to reach the objective and would likely be destroyed by

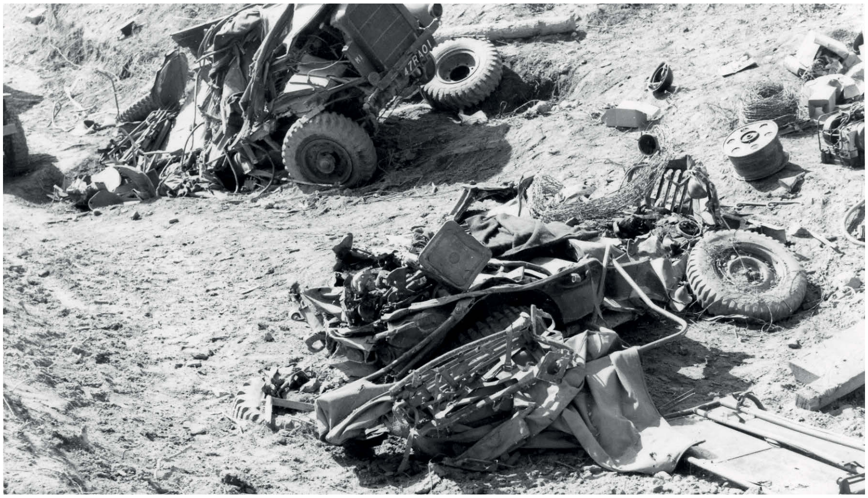


BLACK BESS, the mount of Lieutenant Michael Anstice, fires the 20-pdr main armament during a fire mission by day, showing the damage to trackguards wrought by enemy artillery.

> infantry. My objection was overruled. It was I who had attempted to reach the top and failed, so it was I who had to try again, but in the dark this time.
>
> At 0110hrs I set off having first handed command of the troop to Sergeant [Bob] Nunn, my troop sergeant. We soon reached the bottom of the path and started to climb. Approximately halfway up my driver, Trooper [Taffy] Lewis, said over the intercom that our way was blocked. Indeed it was by a 15-cwt truck and a Jeep both belonging to the gunner OP. I wirelessed for instructions and was told to drive over them. This we did. The tank felt as though it was trying to climb a wall and then subsided as it crushed the two vehicles completely flat. We continued up the path and reached the top, turning left at the company command post. We started to move forward along the ridge firing our Besa when there was the most almighty flash and a thump heard through my headphones followed by a call from Taffy Lewis that he had been hit. We could not see forward as the mantlet cover had caught fire and to add to our difficulties we were being subjected to heavy machine gun fire.

From the gunner's seat, Trooper Ron Marks had a restricted view of the battlefield through his sights:

> When we got to the top we had to move along a ridge where the Black Watch were dug-in. I think it was the only time that the infantry were pleased to see a tank driving over their trenches – all the while under heavy Chinese fire. I was busy returning fire with the 20-pdr and the coax by the light of the searchlight. We had to be careful not to illuminate the Black Watch. The enemy were so close I was able to see their padded jackets. There were hundreds of them coming up the slopes. The Black Watch must have been absolutely terrified. The Besa jammed twice and Pete had to release it each time but we managed to take out quite a few of them. It jammed a third time so Pete put HE up the spout and tried to clear the machine gun. The next thing I knew there was a blinding



The Royal Artillery Willys Jeep and Morris Commercial 15-cwt truck that were in the path of BLACK BESS lie crushed on the track up to the Hook position.

> flash. I saw flames through my gunner's sight and heard Taffy groaning and swearing. The searchlight then failed as the flames burnt through the connecting wires. Bearing in mind I was just 19 years old at the time I did not feel any fear at all – that came later. Everything was happening too fast. Over the net I heard the colonel of the Black Watch telling Lieutenant Anstice to turn off the searchlight and he replied 'The searchlight is out, the tank's on bloody fire. Wait out!' Pete Williamson then grabbed a fire extinguisher and opened his hatches to lean out over the turret roof and fight the flames but it was just one of those hand pumped Pyrene extinguishers and while the flames subsided the canvas and lubricating grease for the trunnions was still smouldering. I traversed the turret so that we could get access to the driver's compartment and Pete dragged Taffy back into the turret with great difficulty because of his size and his wounds. We could only give him basic first aid as Pete had to drive the tank and I had to fire the guns but I couldn't move the turret as this would have bashed into Taffy.

Corporal Williamson's recollections were equally vivid:

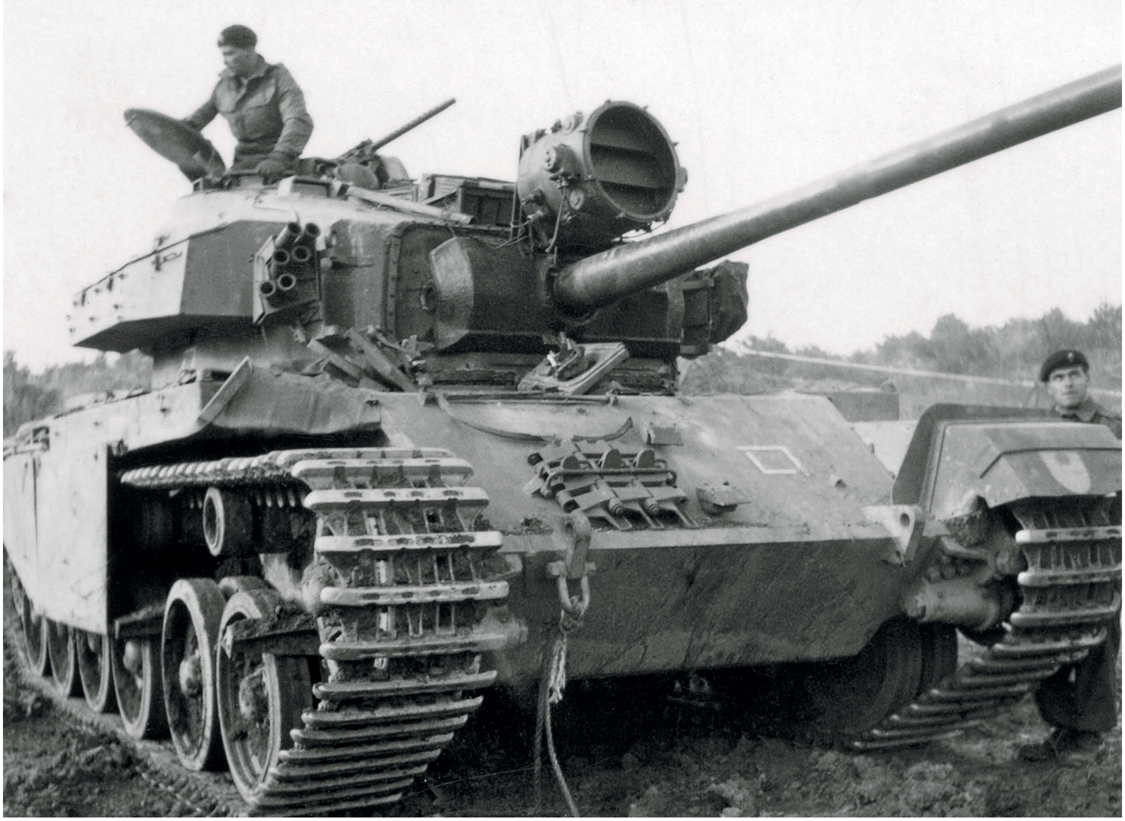
> When we reached the top of the Hook the Black Watch put in their counterattack. We started firing in support. We got off one belt of Besa and were half way through the second belt when there was a loud explosion. Smoke and flames poured into the turret. The driver Trooper Taffy Lewis started screaming that he had been hit. We had been penetrated by a 3.5-inch bazooka rocket fired at very close range. The gunner Trooper Ron Marks yelled out that we were on fire. My reflex action was to grab a fire extinguisher, open my hatches and climb out. I managed to put out the fire and climbed back in and closed down. Lieutenant Anstice looked across at me and said "You crazy bastard there were Chinese all around us and firing at you. Every time I tried to open my hatch the bullets kept pinging off it."
> Williamson continued;
> Our next concern was to see to Taffy Lewis. Ron Marks traversed the turret round so that it gave me room to drag Taffy into the turret. I did what I could but the boss asked me if I could drive. I told him my second trade was driver so he told me to take over. I scrambled into the driver's seat. I found Taffy's headset and though they were wet I put them on. I quickly realized they were wet with blood. The boss came over the intercom and guided me in reverse down the hill.

Lieutenant Anstice remembered the battlefield being bathed in an eerie blue light:

> The scene on the Hook was like Dante's inferno. Chinese infantry were again caught in the open and being subjected not only to our shells but theirs too. We were stuck in the middle of this – immobile and wondering what to do next. The Chinese had witnessed our failed attempt to get a tank up the hill and rightly deduced that we would try again, so sent an ambush party with a 3.5-inch rocket launcher to intercept us. We were hit at point blank range and holed through the glacis plate. Fortunately the rocket failed to burn through the last fraction of an inch and on bursting blew the remaining metal into Trooper Lewis. We pulled Lewis through into the turret where he lay on the floor, his body preventing the turret from traversing. Corporal Williamson scrambled into the driver's compartment and then with me directing and him driving we reversed all the way back down the track, finishing off the jeep and truck en route.

All the while, the searchlight of Four Able commanded by Sergeant Bob Nunn illuminated their path down the treacherous track. Trooper Brindley in Callsign Four Charlie recalled:

> Williamson was driving Four down the hill and poor Taffy Lewis, the driver and my best friend, was badly wounded. At the bottom of the hill there was a long pause while Taffy was evacuated and the battle raged around whilst I cowered lonely behind my episcopes wondering what was going on.



On the day after the battle, B Squadron Second Captain, Captain Bob Walters RTR, inspects BLACK BESS for damage. The bazooka round caused the canvas mantlet cover to catch fire and burnt through the connecting wires of the searchlight above the 20-pdr gun.

Lieutenant Anstice continued:

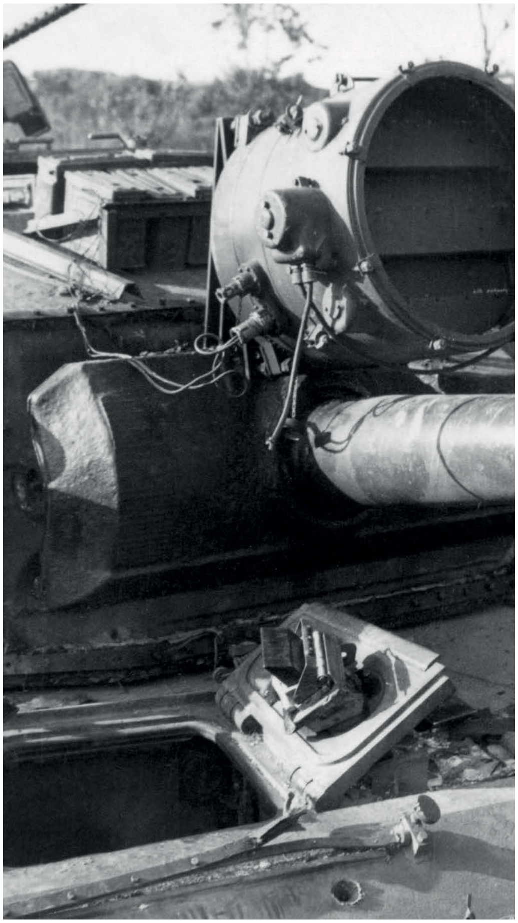
> Mortar fire was still heavy as we stopped outside the Black Watch regimental aid post which was conveniently on the way back to our original action station. Trooper Lewis was a big man lying inert on the turret floor. I have never forgotten the effort for Marks and myself to lift him through the turret hatch and off the tank on to a stretcher. We tried to carry Lewis into the aid post. A loaded military stretcher is normally a four-man job. We dropped Lewis twice as we tried to run through the mortar fire.

Trooper Marks recalled:

> We started carrying him to the RAP but dropped him a couple of times. On the second time Taffy got up on his own and said "Fuck you, I'm walking!" He staggered to the RAP holding his guts in with his hands. He was a strong lad, built like a gorilla and just as hairy.

Once inside the RAP Lieutenant Anstice observed:

> The interior of the aid post is an everlasting memory. The yellow light of the hurricane lamps lit shadowy figures moving around inert bodies some covered by blankets with the continual noise of exploding shells outside. It somehow seemed like a scene from the Crimea and not the 20th Century.



The bazooka round strike that severely injured Trooper Fred 'Taffy' Jones is visible below the driver's hatch. Repair was undertaken by inserting a track pin in the hole and cutting it to length with a welded patch on the exterior.

Lance Corporal Williamson remained in the driver's seat of BLACK BESS:

> Once down the hill Lieutenant Anstice stopped me so that he and Ron could get Taffy to the regimental aid post of the Black Watch. I don't think that they were away for many minutes but to me it felt like hours. There I was sitting in a dark tank, no lights on, engine switched off and Chinese shells still landing near us. The driver's hatches had been distorted by the bazooka explosion and every time a shell landed nearby they opened slightly and dirt would dribble on me. I cannot describe the relief I felt when I heard Lieutenant Anstice say driver start up.

The troop leader recalled:

> We then returned to our original position and continued the battle from our hull down revetments. A relief driver [Trooper Bill Ward] was sent out from squadron headquarters. At about 0800hrs I received a message saying that the Chinese were about to attack again. All four tanks had withdrawn from their fire positions to replenish ammunition and fuel as necessary. The threatened attack never materialised. The extremely brave Chinese bazooka team was found dead the following morning on the Hook battlefield. I like to think we shot them but I shall never know.

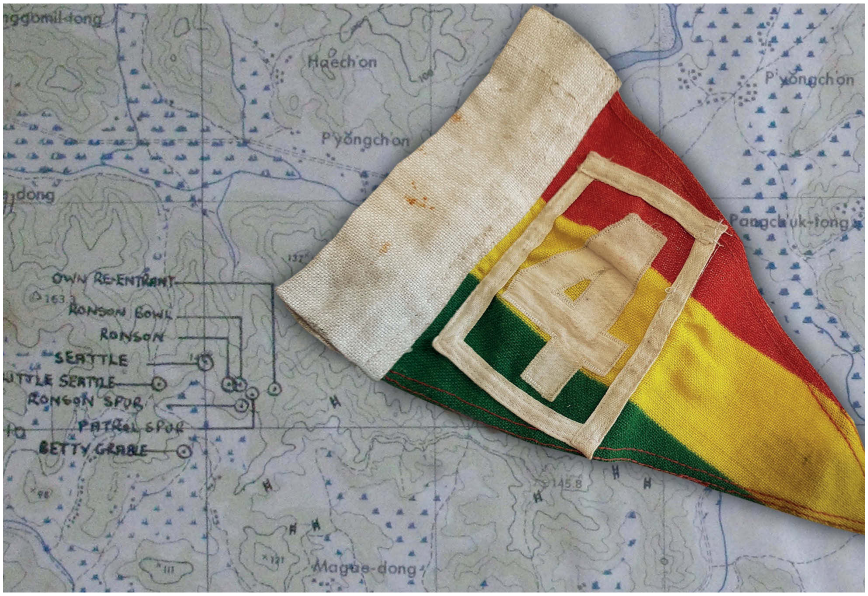
Trooper Ron Marks holds aloft a 3.5-inch bazooka hollow charge projectile of the type that hit BLACK BESS. It was found on the body of a dead Chinese infantryman on the day after the battle.

At 0200hrs A Company of the Black Watch again counterattacked and retook the Hook position. Fire support by 4 Troop was severely compromised because the tanks were being silhouetted by a searchlight shining from the rear and as a result they were heavily shelled and mortared. A pause in the battle ensued until the last Chinese attack came at 0450hrs. At first light a counterattack by C Company 3rd Battalion Princess Patricia's Canadian Light Infantry supported by tanks of B Squadron Lord Strathcona's Horse finally secured the Hook by 0815hrs. At 0940hrs 4 Troop B Squadron withdrew to their harbour positions after nine hours close engagement with the enemy. Lieutenant Michael Anstice was awarded the Military Cross for his gallantry.

The last word goes to Trooper Ron 'Groucho' Marks:

> We came off the Hook after three days and three nights without eating properly or getting out of the tanks except to bomb up with ammunition and when we got back, everyone was waiting in line at the mess tent to get breakfast. To a man they stood aside to allow the Centurion crewmen of 4 Troop to walk to the head of the queue.

For the duration of the war, the Hook feature remained the scene of fierce fighting as the peace talks continued in Panmunjon. In May 1953, the Centurion tanks of 2 Troop C Squadron 1st Royal Tank Regiment fought a similarly decisive action in



The pennant flown by BLACK BESS during the battle of the Hook is shown on a map of the Hook position with the enemy hill features named and the symbols indicating where the tanks were located in support of the forward infantry companies.

support of 1st Battalion The Duke of Wellington's Regiment in one of the final actions of the Korean War.

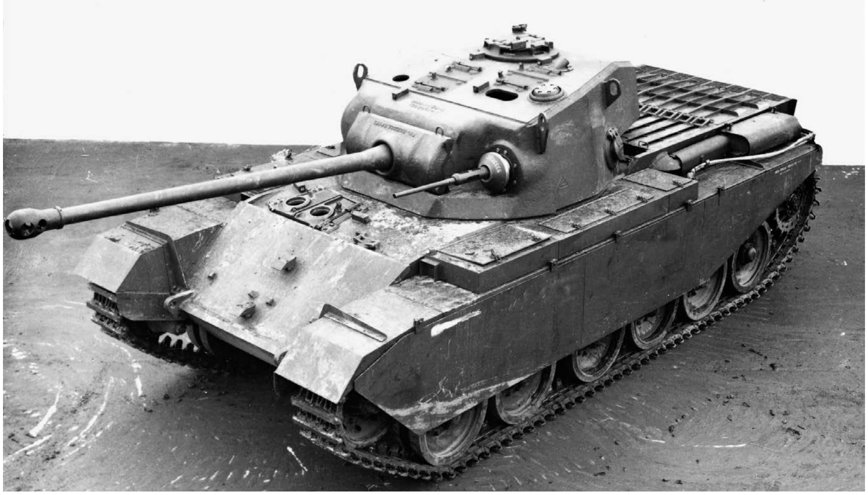
CENTURION DESIGN AND DEVELOPMENT

During World War II, British tanks were severely compromised by the misguided doctrine of employing three specific types of tanks to conduct armoured operations. Small, fast, light tanks were employed for reconnaissance and scouting. A class of slow, heavily armoured 'Infantry' tanks was designed to assault enemy strongpoints and fortified positions in direct support of the advancing infantry in a manner similar to the tactics used in 1917–18 on the Western Front. A further class of faster, lightly armoured 'Cruiser' tanks was intended to exploit any success of the infantry attack through the enemy lines or around their flanks in traditional cavalry manner. Not one of these classes of tank was primarily designed to engage and destroy opposing tanks.

Following the evacuation of the British Expeditionary Force at Dunkirk in May 1940, Britain was reduced to a handful of tanks. Accordingly, Britain was compelled to continue manufacturing a range of inferior designs in order to field any tanks at all in the only theatre of operations against the Axis powers in North Africa. There a further serious defect of British tanks became apparent. Although fast and highly manoeuvrable, the Cruiser tanks proved to be chronically unreliable. Against the Italians, this did not constitute a major problem as most could be recovered after action. However, in the fast-moving battles against Rommel's Afrika Korps a significant proportion of British tanks was lost to mechanical breakdowns; often over half of those committed on an operation. As a further measure of the low esteem in which British tanks were held, although the Afrika Korps invariably pressed every captured Allied vehicle into service to bolster its depleted inventory, it rarely did so with British tanks apart from the heavily armoured Matilda Infantry Tank Mark II.

During 1942, the British Eighth Army in North Africa began to receive large numbers of American tanks such as the M4 Sherman. The principal virtues of the Sherman were its mechanical reliability and effective dual-purpose 75mm main armament, capable of engaging enemy tanks on almost equal terms although the British tactical handling of armoured formations often remained deficient compared to that of the Germans. Meanwhile, the latter were introducing new and improved tank models following their gruelling experiences on the Eastern Front against the Soviet Union. In particular, the Panzerkampfwagen V, or Panther, introduced in time for the titanic battle of Kursk in July 1943, came as an unhappy surprise to the western Allies; they had nothing to compare with this powerful tank that incorporated

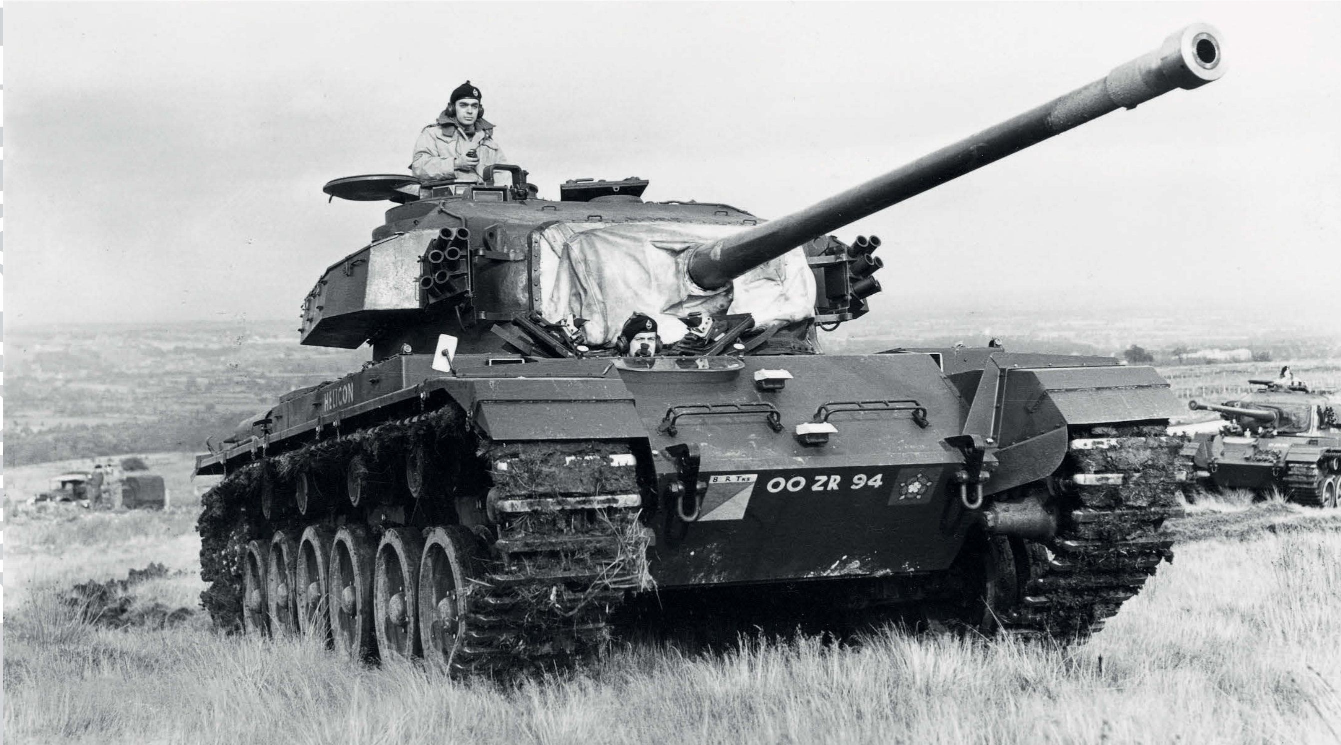
During World War II, the British Army continued the misguided armoured doctrine of employing two distinct types of tanks – the Infantry Tank and the Cruiser Tank. The former was slow but heavily armoured to support the infantry in the attack while the latter was less well armoured but more mobile to exploit punctures in the frontlines achieved by the infantry attack. Here, a Valentine Infantry Tank Mark III advances in company with infantry during training in the Western Desert of Egypt.



The Centurion was the last in the line of World War II Cruiser tanks and was originally designated as the A41 Heavy Cruiser, as it finally combined the three essential parameters of firepower, mobility and armour protection in a design that matched contemporary German tanks such as the Panther and Tiger, which had been the bane of Allied tank crews throughout the fighting in North-West Europe. This A41 mounts a 20mm Polsten cannon beside the 17-pdr main armament.

thick, well-sloped armour and a high-velocity L/70 calibre 75mm main armament capable of destroying a Sherman tank at twice its combat range in any one-to-one encounter. Consequently, three or four Shermans were often lost in order to destroy one Panther or Tiger – a ratio that had an understandably harmful effect on the morale of Allied tank crews.

By 1943, the British had developed a highly effective 76.2mm 17-pdr anti-tank gun with a similar performance to the 75mm of the Panther. At the time, there was no British tank design capable of mounting such a heavy weapon due to the limited size of their turrets. Numerous redundant tank hulls were modified to carry the new weapon in open-topped turrets as tank destroyers, such as the Archer and Achilles, to support armoured formations but these were of limited value during a major offensive. As an interim measure, hundreds of Shermans were fitted with the 17-pdr by mounting the weapon on its side and extending the turret at the rear. This model

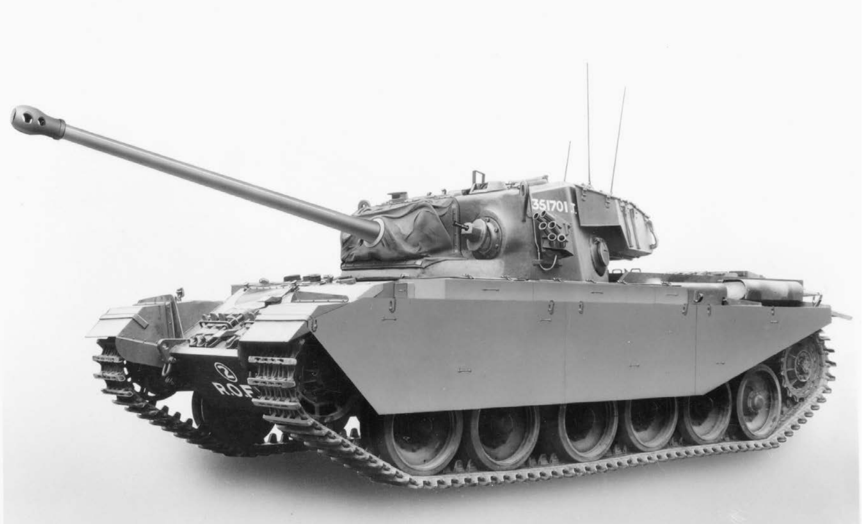


A Centurion Mark 3 of 8th Royal Tank Regiment moves off during an exercise in northern England in 1949. With the introduction of the 20-pdr gun as main armament and APDS (Armour Piercing Discarding Sabot) ammunition, the Centurion became a formidable battle tank throughout the 1950s.

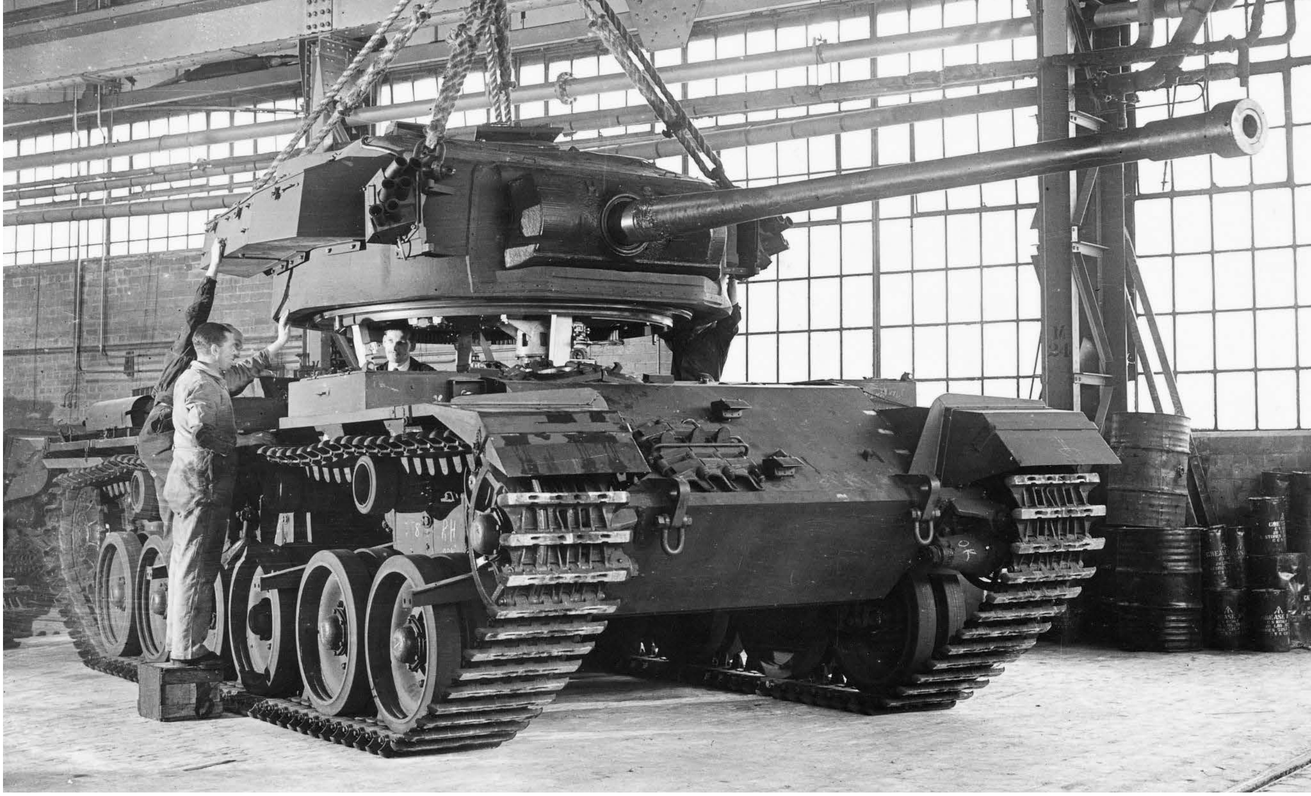
was known as the Sherman Firefly and represented almost one in four tanks in British units. It was a formidable combination and the Sherman Firefly became a priority target for German tank crews and anti-tank gunners during the Normandy campaign in the summer of 1944.

Despite the evidence to the contrary, the British General Staff persisted in the belief of fielding both Infantry and Cruiser tanks although the tide of user opinion favoured the concept of a single, or 'Universal', type. By the time of D-Day in June 1944, the two main types were the Churchill and Cromwell. Both were markedly inferior to their opponents, particularly in terms of firepower as they were still armed with a weapon of similar performance to that of the Sherman, introduced in 1942. To redress this failure, the General Staff set out to design a tank capable of mounting the 17-pdr gun from the outset. Designated the A41 Cruiser Tank, its major characteristics were formulated by the Director of the Royal Armoured Corps (DRAC) at the 35th Meeting of the Tank Board held on 7 October 1943. The tank was to weigh 45 tons with a 650hp petrol engine, well-sloped 3in frontal armour and it was to mount the 76.2mm 17-pdr gun as its main armament. All these features were virtually identical to the Panther, which was by now wreaking havoc among Allied tank formations on the Eastern and Italian fronts, while the A41 was not even on the drawing board.

On account of the previous inadequacies in the design and development of British tanks, the A41 was entrusted to the government-sponsored Department of Tank Design rather than commercial companies. The choice of the main armament established the diameter of the turret ring, which in turn determined the vehicle width. This also had to be kept within specific limits to allow the tank to negotiate Bailey bridges and be transported by rail. The need to thwart attack by German tank and anti-tank guns, including the dreaded 88mm, influenced hull and turret armour thickness and therefore overall vehicle weight. The effectiveness of German anti-tank guns gave rise to a requirement for the A41 to mount a heavy-calibre quick-firing weapon beside the main armament. This was intended to pierce the armoured shields protecting enemy anti-tank gun crews without wasting main armament rounds. The weapon chosen was the 20mm Polsten cannon in a separate independent mounting; this was to be fired by the loader.



The Centurion arrived too late to see action during World War II but six prototypes were deployed to northwest Europe in the closing weeks of the war for trials during Operation Sentry. The Centurion Mark 1 entered service with the British Army in 1946 with a Besa machine gun beside the main armament.

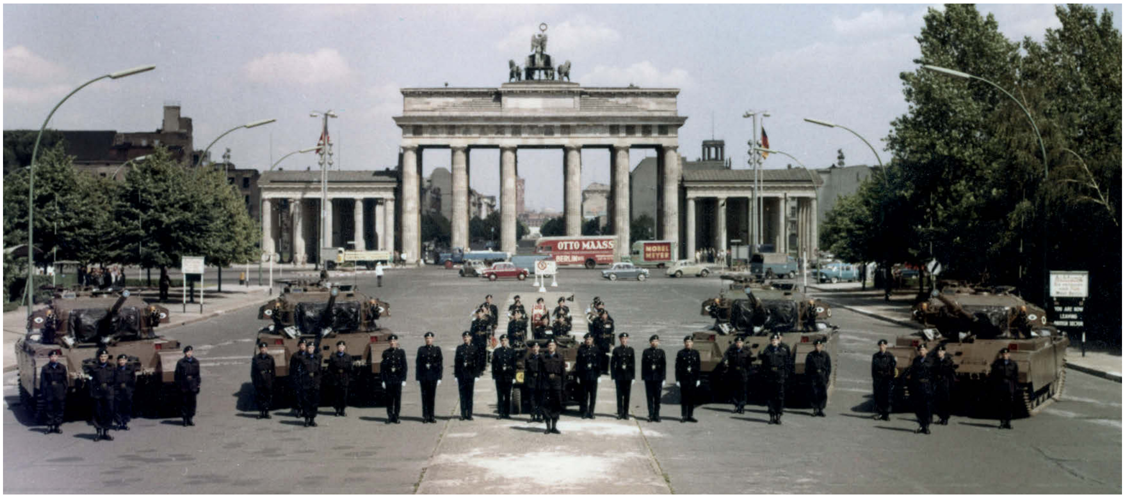


The Centurion Mark 3 was manufactured on two separate production lines at the Royal Ordnance Factory Barnbow in Leeds and at the Vickers Armstrong facility in Newcastle upon Tyne. The Mark 3 was built in greater numbers than any other, with a total of 2,833 between 1948 and 1956.

The engine for the A41 was the Meteor petrol engine, derived from the famous Rolls-Royce Merlin that powered both the Spitfire and Hurricane fighter/fighter-bombers and the Lancaster bomber. Derated to 650bhp, the Meteor gave an adequate power to weight ratio and the desired degree of reliability. It had been well proven in the Cromwell and Comet tanks. The Meteor was coupled to a Merritt-Brown gearbox with five forward and two reverse gears. This delivered power through a differential gear train to provide brake steering control. Again, this system had been proven on the Cromwell and Comet and gave an acceptable combination of power and flexibility for a tank of considerably greater weight. As with all petrol engines, the Meteor posed a significant fire risk and measures were taken to minimise this threat such as stowing all the main armament ammunition below the level of the turret ring. Experience had shown that the majority of knocked-out tanks were destroyed by turret penetrations where stowed ammunition caused catastrophic fires – a particular weakness of the Sherman, which resulted in the loss of many tank crews.

Several suspension systems were considered, as the Christie type of the previous Cruiser tank models was inadequate for a tank weighing as much as the A41. In the end, Horstmann double bogie wheel assemblies were adopted as they gave good cross-country performance and ease of maintenance. These external units were also simpler to replace after mine damage than the internal transverse torsion bar suspension systems favoured by the Germans. One innovation was the installation of an 8hp Morris car engine to act as an auxiliary generator ensuring a source of electrical power for the radios, battery charging, and powering the gun control equipment without having to run the main engine.

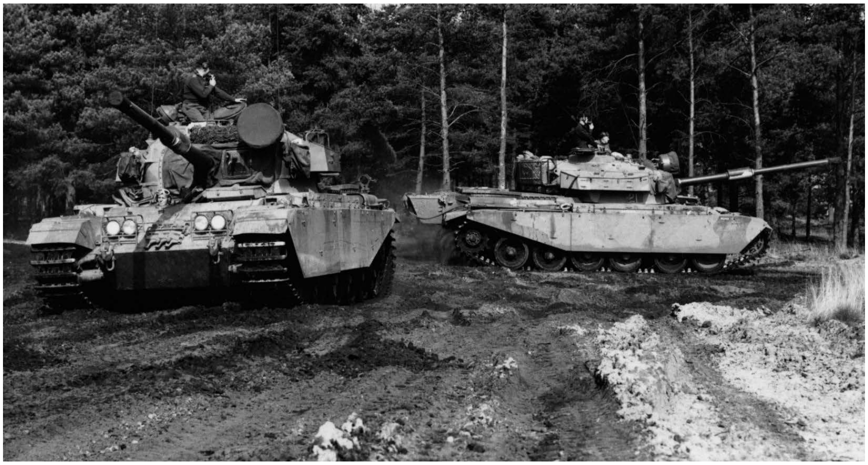
By February 1944, the opinions of frontline soldiers were sought on the configuration of the A41. Although the advantages of the 20mm Polsten for defeating anti-tank guns was realized, there were insistent demands for a forward-firing coaxial machine gun. The aiming and firing of the Polsten 20mm by the loader was



A troop of immaculate Centurions Mark 5/1 of 4th Royal Tank Regiment with the Chinese Eye insignia prominent on the turret stowage bins stands on parade in front of the Brandenburg Gate in Berlin. Note the tanks are painted in US Olive Drab that was particular to British tanks of the Berlin Brigade.

considered to be a distraction from his main tasks of serving the main armament and operating the radios. Even so, it was decided to build the first prototypes with various combinations of secondary armaments, including the 20mm Polsten. A final specification for the A41 was considered and accepted at the 38th Meeting of the Tank Board held on 23 February 1944. The Tank Board recommended the production of 20 prototypes, with their manufacture being shared between the government ordnance factories at the Woolwich Arsenal and Nottingham.

On 24 May 1944, just days before the invasion of Europe, an Extraordinary Meeting of the DRAC's Advisory Committee was held at AEC Limited of Southall to view the mock-up of the A41 and the final details for the various prototypes were determined. Over the following months detailed production plans were drawn up and various manufacturers fabricated components. Due to the demands to continue producing existing tank designs to replace the high losses of the Normandy campaign, the manufacture of the A41 prototypes did not begin until January 1945. Meanwhile, the design of a new fully cast turret was under way. This gave greater ballistic protection as well as incorporating a conventional coaxial machine gun and a commander's cupola with all-round vision blocks. The new turret was to be fitted onto a design designated as the A41A Heavy Cruiser Tank.

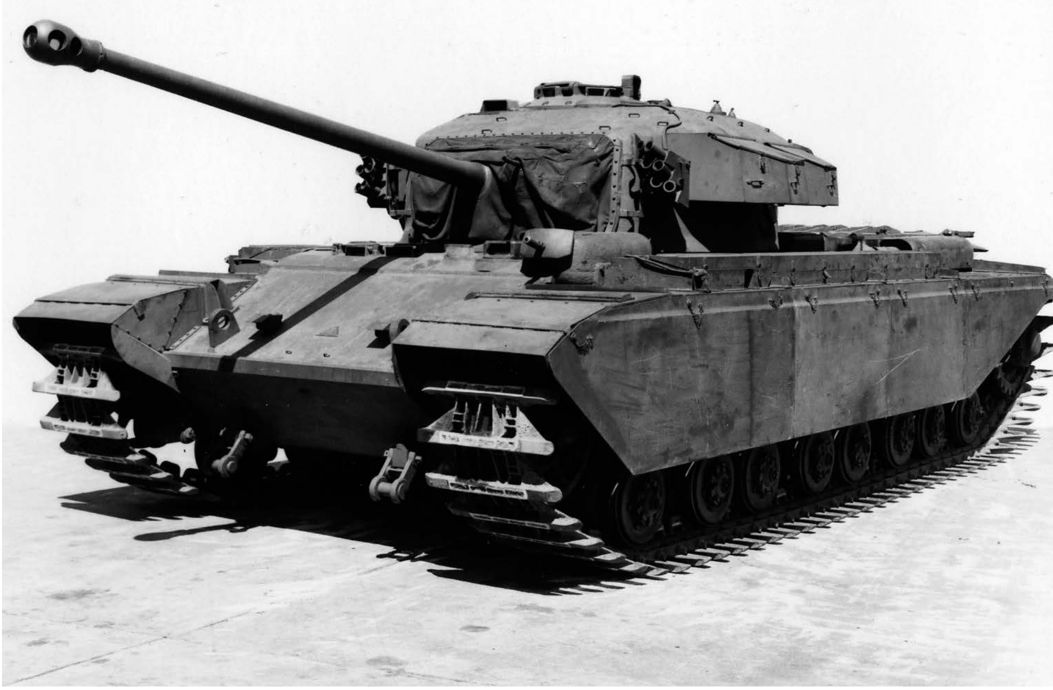


Throughout its long service career, Centurion was repeatedly upgraded from its original 17-pdr gun to the 20-pdr and then the outstanding L7 105mm gun, while its armour was increased on the glacis plate, and night fighting equipment was added as well as an enhanced fire-control system. These Centurions were originally Mark 5 but have become Mark 11 with all the above improvements. In addition, they feature 100-gallon auxiliary fuel tanks on the back to increase the inadequate range of the early versions.

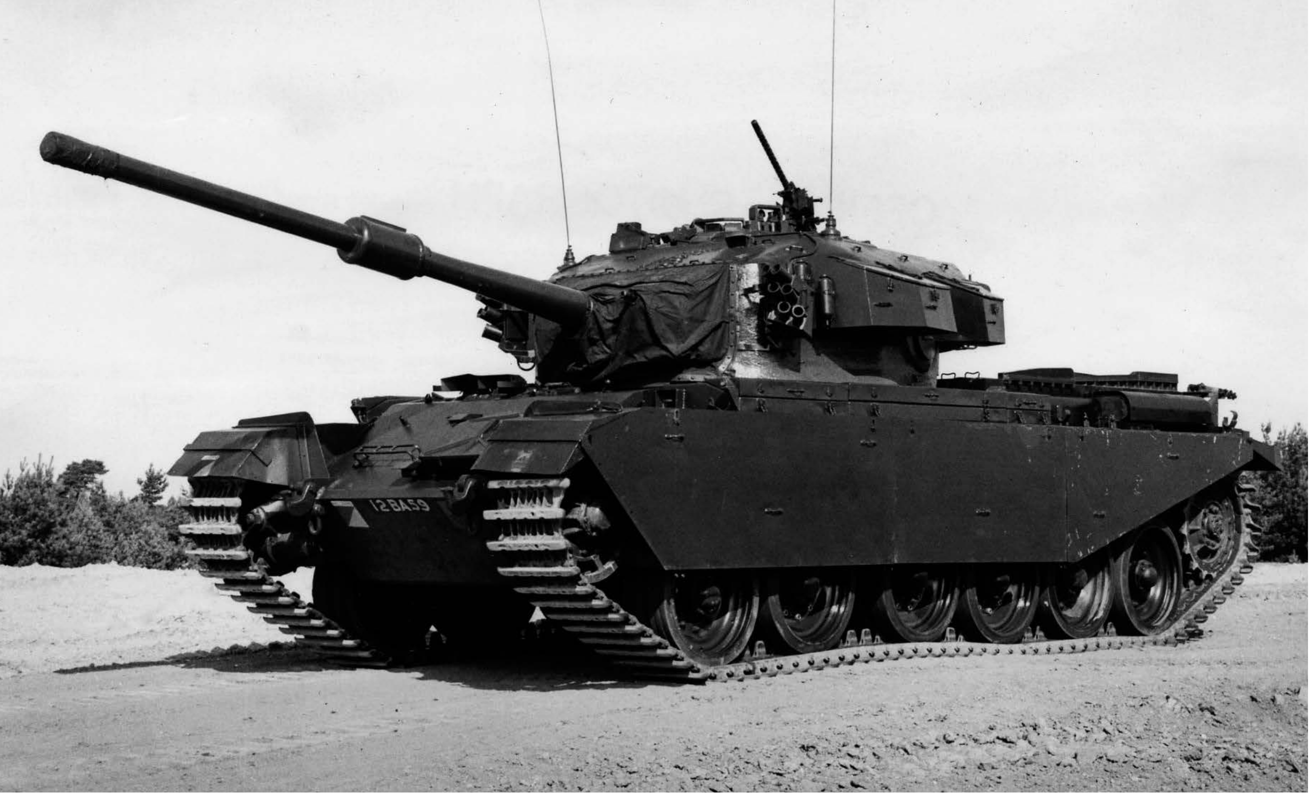
In April 1945 the first A41 prototype was delivered from Woolwich Arsenal in southeast London to the Fighting Vehicles Proving Establishment at Chertsey in Surrey. By now, the A41 Heavy Cruiser was called the Centurion, although this name had originally been allocated to the A30 – a lengthened Cromwell chassis mounting a 17-pdr gun as a tank destroyer that became the Challenger. Performance trials of the Centurion began immediately and they proved to be so trouble-free that it was decided to despatch some of the early prototypes to northwest Europe to prove them under active service conditions. Under the codename Operation Sentry, six Centurion prototypes arrived in Belgium soon after VE-Day for trials with the 5th Royal Inniskilling Dragoon Guards and 5th Royal Tank Regiment. The trials continued into July and user opinion of the new tank was high, though the 20mm Polsten secondary armament did not find favour and a coaxial machine gun was preferred.

The findings of Operation Sentry were considered at the 22nd Meeting of the DRAC's Advisory Committee held on 22 August 1945. As none of the criticisms were significant, a production programme for 800 Centurions was authorized including 100 A41*, or Centurion Mark 1, mounting a 17-pdr gun and a linked 7.92mm Besa machine gun. The remainder were to be the A41A model, or Centurion Mark 2, of which the first 100 were to have 17-pdr guns and later versions the 83.4mm 20-pdr gun then under development. Production of the Centurion began in November 1945 and the first models were delivered in February 1946. By October, a revised turret incorporating the 20-pdr gun was approved and the Centurion Mark 3 became the standard model with production beginning in early 1947. By now, the earlier marks were in widespread use with the British Army, but the Centurion was not intended to be in service for long.

The General Staff was now wedded to the idea of a Universal Tank to replace the discredited Infantry and Cruiser types including the Centurion, which was seen as the last in the line of the lamentable wartime Cruiser tank designs. In September



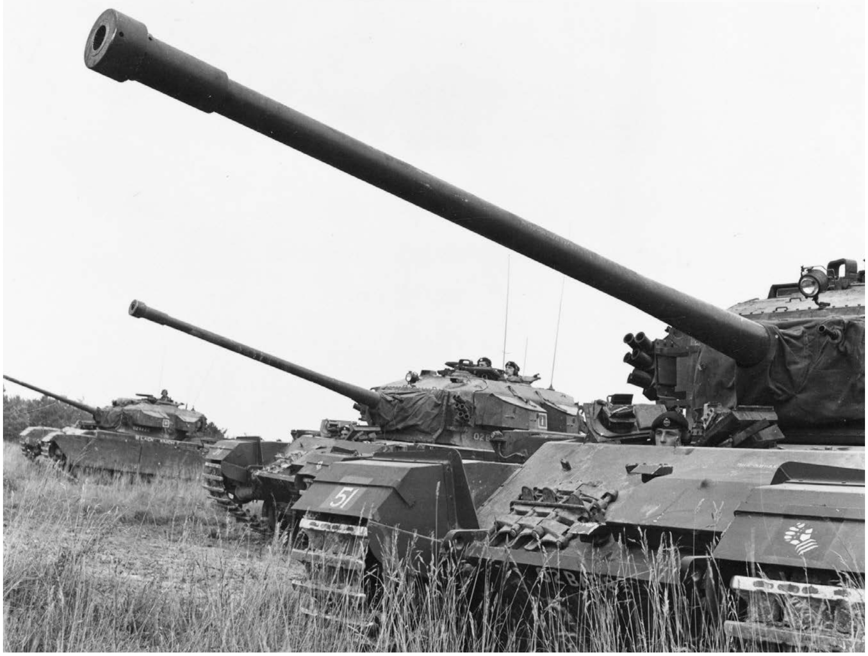
The A45 Universal Tank was intended to supersede the Centurion and replace the discredited Cruiser and Infantry classes of tanks with a single type. However, it never entered service except as the FV214 Conqueror Heavy Tank. This unarmoured experimental FV201 hull is fitted with a Centurion Mark 2 turret for trials purposes.



This Centurion shows the classic configuration of the Mark 5 model, with almost all the significant exterior modifications introduced during the 1950s visible, including the 20-pdr Type B gun barrel; gun depression rails modified to accommodate the fume extractor; RCP sight; gunner's sight wiper and commander's L3A2 Browning machine gun.

1946, the General Staff authorized the design of the A45 Universal Tank, subsequently designated the FV201. Fundamental to the design was the ability of the FV200 series to be adapted to a range of specialized variants such as flamethrowers, mine flails and amphibious assault; indeed all the roles undertaken by the special-purpose AFVs of the 79th Armoured Division during World War II. As it was thought that the Centurion could not be modified to undertake these tasks, the FV201 was to replace it. However, until such time as the FV201 entered service, production of the Centurion was to continue. The first prototype of the FV201 appeared in October 1947, but the design of several of the specialized variants proved to be difficult without major modifications to the basic hull. This compromised the Universal Tank concept to an unacceptable degree and, in October 1948, the FV201 gun tank was cancelled. The development of the family of special-purpose variants continued at a leisurely pace until it too was cancelled in 1949. After a false start using redundant Churchill hulls, a complete family of special-purpose AFVs was subsequently built around the Centurion despite the earlier reservations of the General Staff.

The huge number of Soviet tanks in service along the Iron Curtain remained a formidable threat and the appearance of the heavily armoured Iosef Stalin 3 with its powerful 122mm main armament at the Berlin victory parade in 1945 had caused consternation among the western Allies. Neither the Americans nor the British had anything comparable and both nations identified the need for a heavy tank of similar characteristics. The Americans developed the M103 Heavy Tank mounting a 120mm gun. With the demise of the FV201, the British began the development of a new turret mounting the same 120mm gun to be fitted on a modified FV201 chassis. The resulting vehicle was designated the Heavy Gun Tank FV214 Conqueror. The first prototypes were running by early 1952. Troop trials of Conqueror began in 1955 and it entered service in 1956. Thus, the so-called Universal Tank that was intended to supersede the Centurion finally emerged as a specialized long-range tank destroyer in



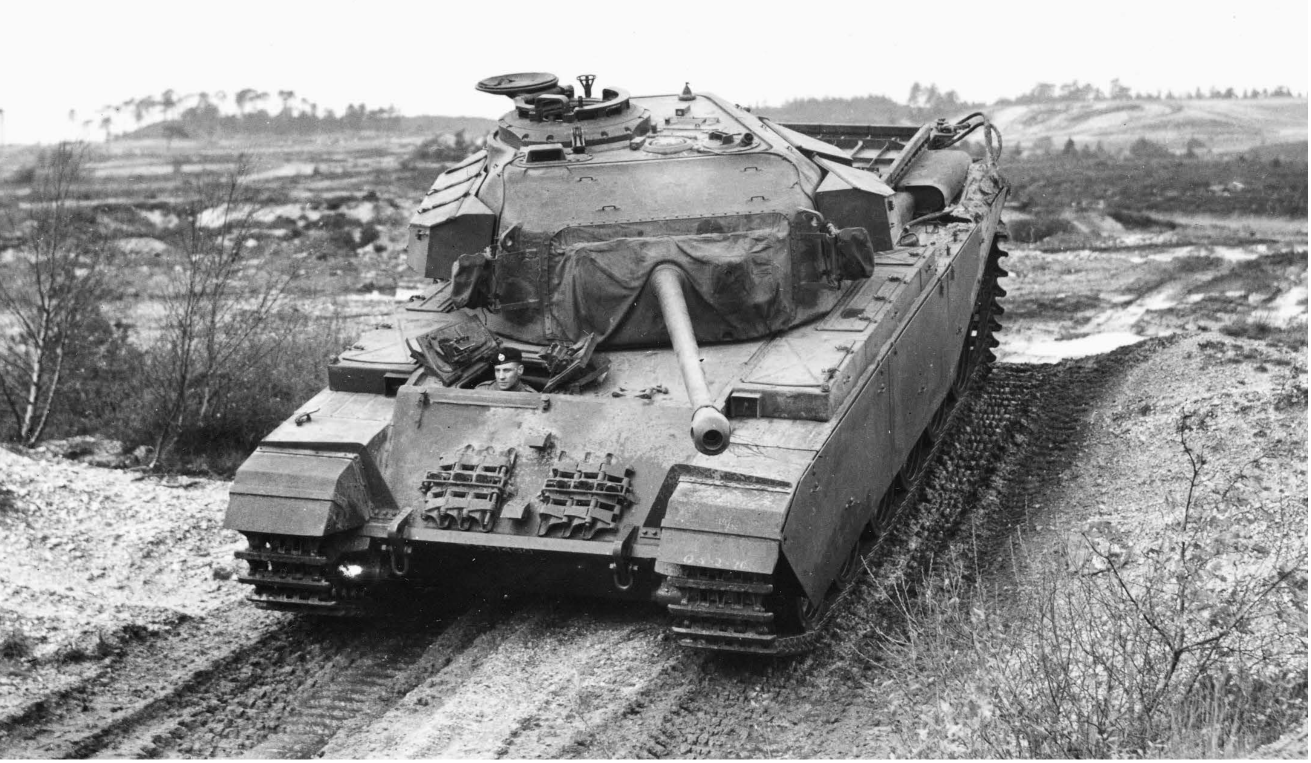
A trio of Centurion Mark 3s display to advantage the Type A 20pdr gun barrel with its counterweight at the muzzle and no fume extractor. These are mid-production Mark 3s with side-loading stowage bins on the trackguards and the loader's periscope on the forward face of the turret roof. On the glacis plate beside the spare tracklinks is a stowage bin for the driver's windscreen and hood for driving with the hatches open in inclement weather conditions.

only limited numbers. Ironically, the performance of the L7 105mm gun that was subsequently fitted to later marks of the Centurion obviated the need for a heavy tank such as the Conqueror and it was withdrawn from service in 1966. By default, the Centurion became Britain's Universal Tank.

The effectiveness of the Heavy Tank concept was further undermined by the introduction of a revolutionary form of armour-defeating ammunition – APDS or Armour Piercing Discarding Sabot. Based on an invention by a Czech scientist, Pete Permutter, who fled from the Nazis, the APDS kinetic energy projectile greatly increased the penetrating power of any round of a given calibre. The APDS round was introduced with the Centurion Mark 3, which entered widespread service with the British Army in 1948. It was one of the main reasons that the Centurion was deemed to be superior to contemporary Soviet tanks such as the IS-3 following combat effectiveness trials conducted in the same year. Another important factor was the superiority of the Centurion's fire control system over other models. This incorporated an effective gun stabilization system that allowed the gunner to track a target while on the move and speed up tank engagement times significantly. It was but one aspect that made the Centurion such a capable battle tank.

TECHNICAL DESCRIPTION: CENTURION MARK 3

Like most tanks of the period, the Centurion was of conventional layout. The forward part of the vehicle was divided lengthways with the driver's compartment on the right and a 20-round ammunition bin on the left, together with a ten gallon fresh water container. The fighting compartment occupied the centre of the vehicle with the fully rotating turret housing the commander and gunner on the right of the main armament and the loader to its left. To the rear was the engine compartment containing the Meteor main and auxiliary engines, fuel tanks and air cleaners. Behind

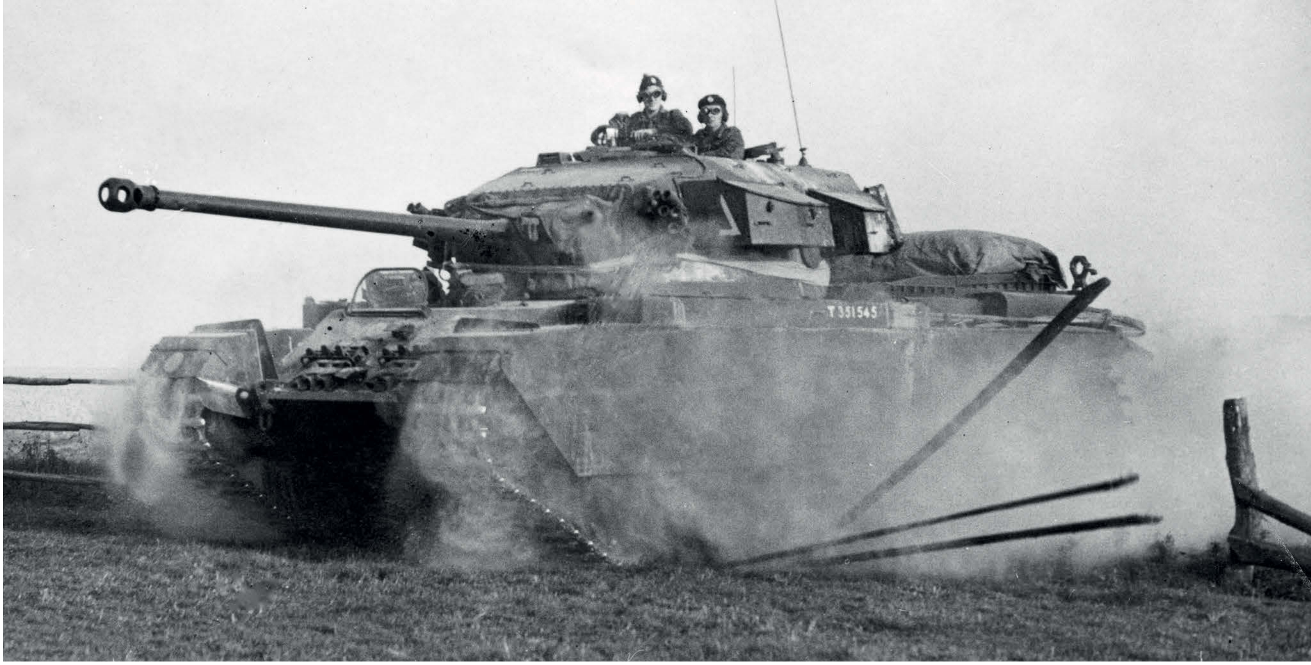


The first model to show the definitive layout of the Centurion was the Mark 2, revealing the fully cast turret with its distinctive stowage bins and commander's cupola with all-round observation from under armour. Although it entered service in 1947, its performance was only comparable to the Panther, which appeared in 1943, but, like all great tank designs, the Centurion had considerable potential for development and improvement to keep abreast of current technology.

the engine compartment were the Merritt-Brown gearbox, cooling fans, radiators and steering brakes driving the rear-mounted sprockets.

Access to the driver's compartment was through two interlocking, spring-assisted hatches located in the hull top plate. The driving controls consisted of clutch, brake and accelerator arranged from left to right; a centrally mounted gear stick and steering levers on each side of the driver's seat with the handbrake positioned on the extreme right. Also to the driver's right were the instrument panel and engine controls, and to his left two CO2 fire extinguishers. The driver had two periscopes in his hatches for viewing when closed down, although his vision to the left of the vehicle was limited. Direction of travel of the tank was controlled by the two steering levers, which altered the relative speeds of the tracks. By pulling the left-hand lever, the speed of the inner track was reduced while the epicyclic trains increased the speed of the outer track causing the vehicle to turn to the left. Depending on which gear was engaged, the gearbox gave a fixed steering radius so the lower the gear, the sharper the turn. The Centurion was also capable of a neutral turn, which meant it could rotate around its own axis. This feature was very useful for manoeuvring in confined spaces. Simple mechanical linkages without hydraulic assistance activated all the controls. Although these enhanced reliability and simplified maintenance, it meant that the Centurion required a modicum of physical strength to drive and was tiring over long distances or over broken ground that required frequent gear changes.

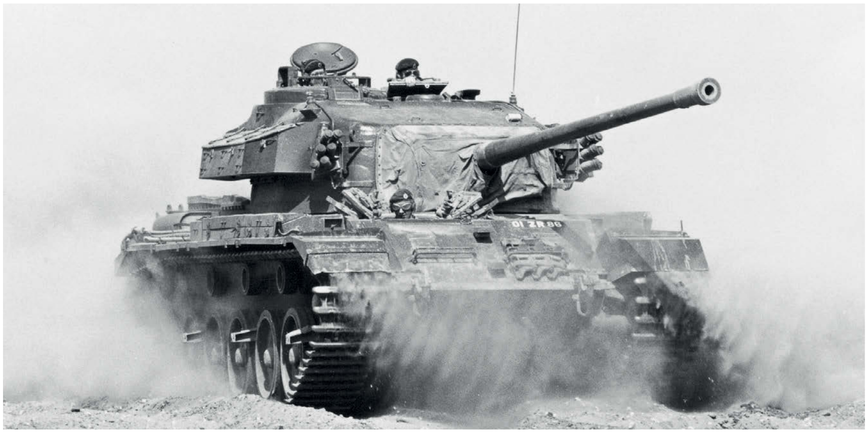
The power-operated turret contained the main armament and auxiliary weapons and the remainder of the four-man crew. The commander was situated at the right rear of the turret with a vision cupola above his position providing all-round observation from under armour. He also had a x10 binocular periscope for precise target acquisition. Forward of the commander was the gunner's position with his gun controls to his front and right. The main armament of the Centurion Mark 3 was the Ordnance QF 20-pdr (83.4mm) Tk Mark 1 gun mounted in a rectangular mantlet together with a coaxial



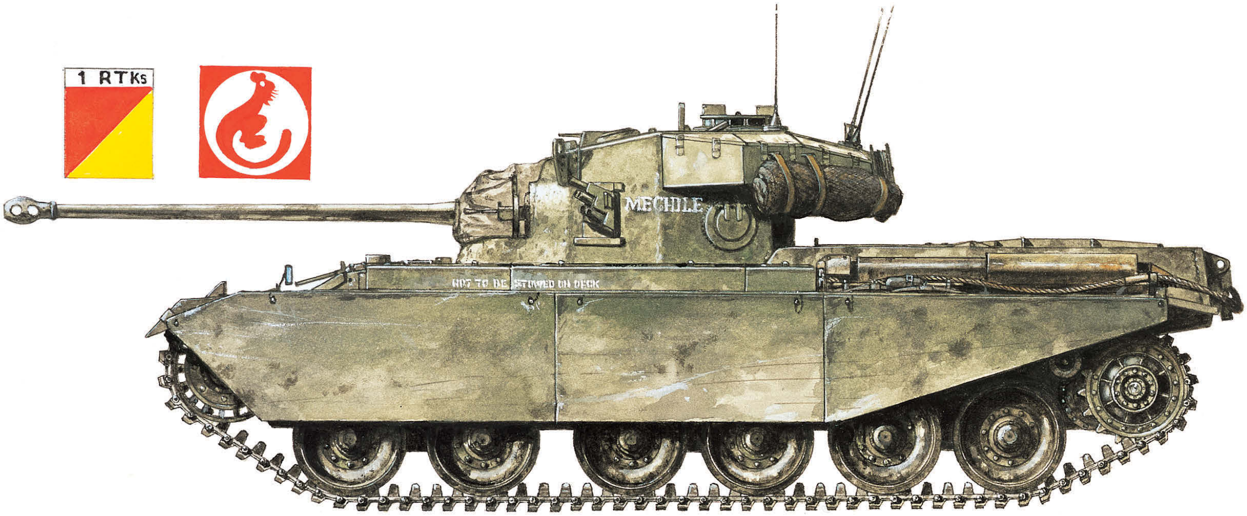
The British Army of the Rhine was reactivated in Germany in August 1945. As an occupation force, tanks were able to go wherever they wished such as this Centurion Mark 2 smashing through a farm fence during a training exercise soon after deployment to Germany in 1947.

.303in (7.92mm) Besa machine gun. The 20-pdr gun was a multi-purpose weapon designed to fire high-velocity armour-piercing rounds for destroying AFVs and medium-velocity high-explosive (HE) shells against unarmoured targets and field fortifications. It also fired canister shot as a close-range anti-personnel weapon, smoke shells and practice rounds. The Centurion was one of the first tanks with an efficient gun stabilization system to allow it to fire on the move. In combination with a well-trained gunner, the Metrovick FVGCE No.1 was highly effective against area targets when engaging with HE or defensive machine gun fire. It also allowed the gunner to track a pinpoint target while on the move and then stop to engage it quickly at the 'short halt' before moving off rapidly to avoid retaliatory fire.

The third crewmember in the turret was the loader-operator. He was positioned to the left of the main armament from where he loaded the 20-pdr gun and served the coaxial machine gun by feeding it with ammunition and clearing any stoppages. As if this was not enough, he also operated the two radios located in the rear turret bustle – the No.19 WT and No.38 AFV wireless sets. The No.19 set also incorporated the crew intercom for communications between crewmembers. The Centurion carried 65 rounds of 20-pdr ammunition of various types of which ten were readily



01ZR86 began life as a Mark 3 but eventually became a Centurion Mark 5/1 with the substitution of the 7.92mm Besa coaxial machine gun with the Browning .30-calibre and the addition of supplementary armour on the glacis plate. The tank retained its original Type A 20-pdr gun even into the 1980s when it served for driver training and demonstrations at Gallows Hill, Bovington.


1 RTKs
MECHILE
NOT TO BE STOWED ON DECK

CENTURION MARK 1, B SQUADRON, 1ST ROYAL TANK REGIMENT, DETMOLD, GERMANY, 1947

The Centurion entered service with the British Army in December 1946. One of the first units to receive the tank was 1st Royal Tank Regiment, known at the time as the 'Prime Panzers'. The vehicle is painted Deep Bronze Green and carries the famous red jerboa of the 7th Armoured Division. On the left of the glacis plate is the Royal Armoured Corps arm-of-service flash surmounted by a white bar with the legend 'I R Tks' (the correct abbreviation of 1st Royal Tank Regiment) superimposed in black. The name 'MECHILE' on the turret sides indicates a Centurion of B Squadron, as their tanks were named after regimental battles of the North African campaign and Italy. A Squadron tanks displayed those of A Battalion during the Great War while C Squadron named theirs after battles in northwest Europe. Shipping instructions are painted on the right front track guard indicating the port of destination – Hamburg – and the shipping number FSO 9925/3 and, on the side of the track guard stowage bins, the directive 'NOT TO BE STOWED ON DECK'. Other markings include the vehicle registration number T351822 on the top right of the glacis plate below which is stencilled 'THIS VEHICLE IS FILLED WITH ANTI-FREEZE 1.8.46. & MUST NOT BE DRAINED'.

accessible to the loader. Besides the coaxial 7.92mm Besa Mk 3/1 machine gun, the loader also served the 2in Bombthrower Mk 2 located in the turret roof beside his periscope. This weapon fired HE, White Phosphorus (WP) and illuminating flares out to a range of approximately 300 yards. It was designed to engage infantry at close quarters following the wartime experience against German Panzerfaust and Panzerschreck teams. Although an effective weapon, its breech intruded into the turret space and the loader often knocked his head against it so it was never popular. A more effective device for masking the tank was the smoke grenade discharger fitted on each side of the turret forward of the stowage bins. Each discharger had three pairs of tubes to fire WP smoke grenades out to a range of 60 yards. The resulting smokescreen allowed the tank to withdraw to cover.

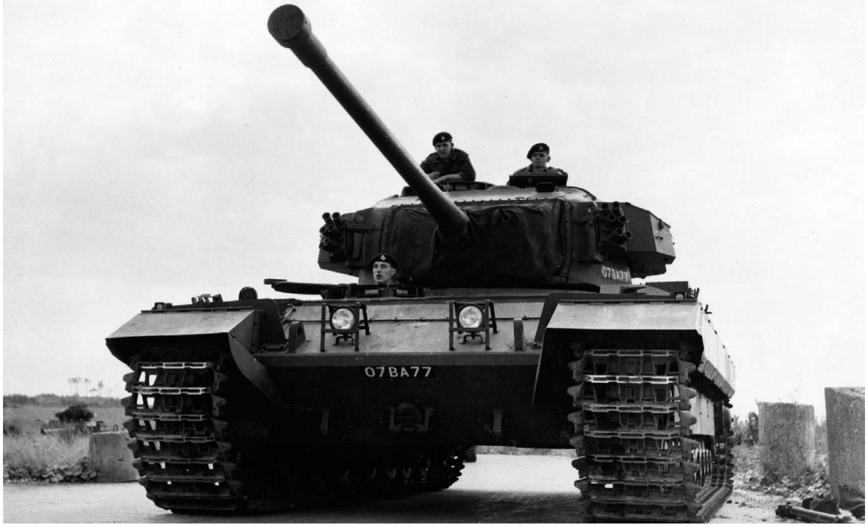
The engine compartment was divided from the turret by a fireproof bulkhead. The latter incorporated the turret ventilation system, the auxiliary engine controls and a two-round ammunition bin. A Meteor Mk 4B 12-cylinder V-type liquid-cooled petrol engine developing 650bhp at 2,250rpm powered the tank. Although a known fire risk, the choice of a petrol engine was determined by the wartime policy to obtain the widest possible range of fuel from a given quantity of crude oil. The Royal Navy had priority for diesel; the Royal Air Force for high-octane aviation fuel, while the Army was reliant on petroleum spirit. However, a petrol engine is less efficient than diesel and has a higher fuel consumption. This gave rise to the principal shortcoming of the Centurion – its inadequate range of approximately 50 miles. Across badly broken ground or in dense jungle it was even less. The auxiliary 4-cylinder Morris engine was located in the forward left-hand corner of the engine compartment. It was used to charge the batteries or provide power for the turret traverse or radio sets. It was also a vital source of power for the boiling vessel in the turret that provided the crew with a constant supply of hot water for cups of tea and heating combat rations.

Power from the main engine was transmitted through a Borg and Beck triple plate dry clutch to the transversely mounted Merritt-Brown Z51R gearbox. The transmission consisted of a combined steering and braking mechanism that drove the two sprocket assemblies mounted at the rear of the vehicle. This simple system provided maximum power at the sprockets with plenty of torque for enhanced cross-country ability. The vehicle was supported on six Horstmann suspension units with three on each side. Being externally mounted, they were simpler to replace than torsion bars following mine damage. Combined with the boat shape of the hull, this gave greater protection to the crew from the danger of anti-tank mines. The three detachable skirting plates on each side provided further protection for the suspension and hull against attack from infantry hand-held anti-tank weapons. The robust and reliable combination of the Meteor engine, Merritt-Brown gearbox and Horstmann suspension gave a top road speed of around 20mph and a sustained cross-country speed of 15mph without undue discomfort to the crew.

By 1950, production of the Centurion Mark 3 was well under way at a rate of approximately four a week; a considerable number for such a complex piece of engineering by a war-ravaged British industry. The tank was manufactured at the Royal Ordnance Factory Barnbow in Leeds and at the Vickers Armstrong factory at Elswick, near Newcastle upon Tyne. The cost of a Centurion at this time was approximately £38,000 or $100,000. Service with the British Army of the Rhine (BAOR) in occupied Germany had demonstrated the need for many minor improvements and almost 250 modifications were approved for the Centurion Mark 3 production programme. The major problem remained the Centurion's inadequate operational range. Frontline units in Germany tried improvising various supplementary fuel drums at the rear of the tank in a similar manner to Soviet tanks such as the T-34, but they were hardly satisfactory and prone to damage when reversing or in road accidents.

CONQUEROR AND THE IS-3 THREAT

On 7 September 1945, an Allied victory parade to mark the end of World War II was held in the devastated ruins of Berlin. Among the range of AFVs on display were 52 Russian IS-3 heavy tanks of the 71st Independent Heavy Breakthrough Tank Regiment from the 2nd Guards Tank Army. Named after the Soviet leader Iosef Stalin, the tank caused consternation among western observers as neither the UK nor the USA had any comparable design, either in service or beyond the drawing board. Armed with the powerful D-25T 122mm tank gun, the IS-3 featured a distinctive, multi-faceted glacis plate that gave the tank its nickname of *Schuka* or 'pike'. Furthermore, the turret design was of superior ballistic shape to any contemporary design, giving the IS-3 formidable armour protection within an overall battle weight of 46 tons; some ten tons less than that of the Tiger and 20 tons less than Tiger II.

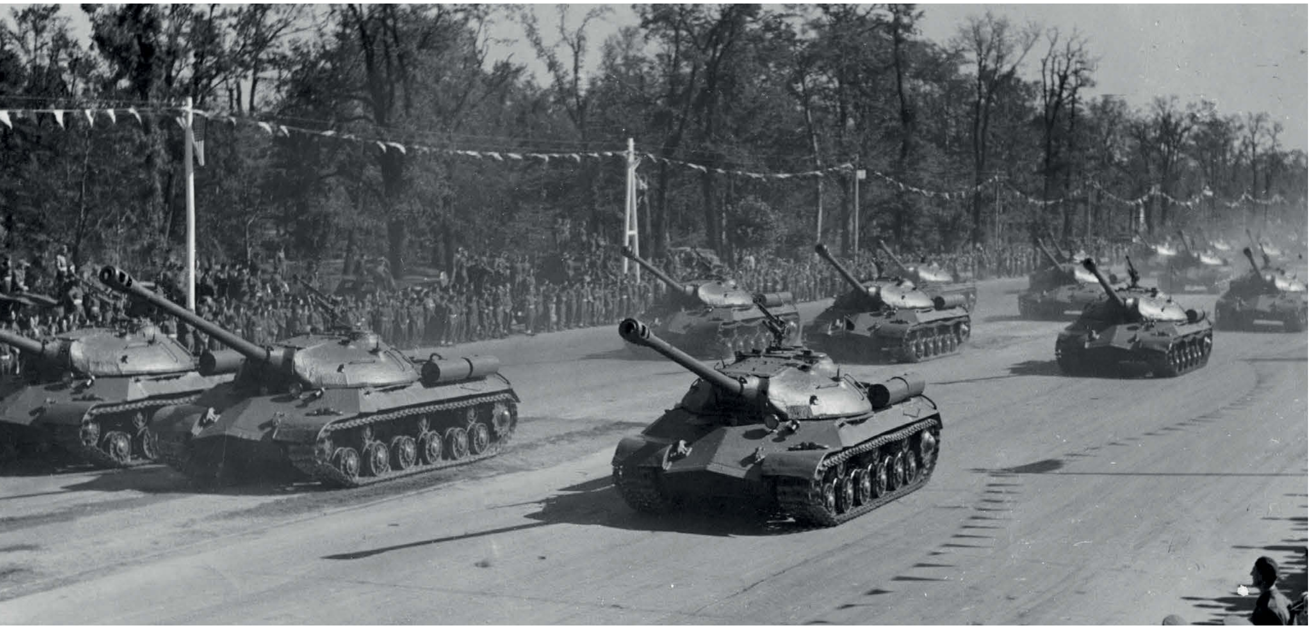


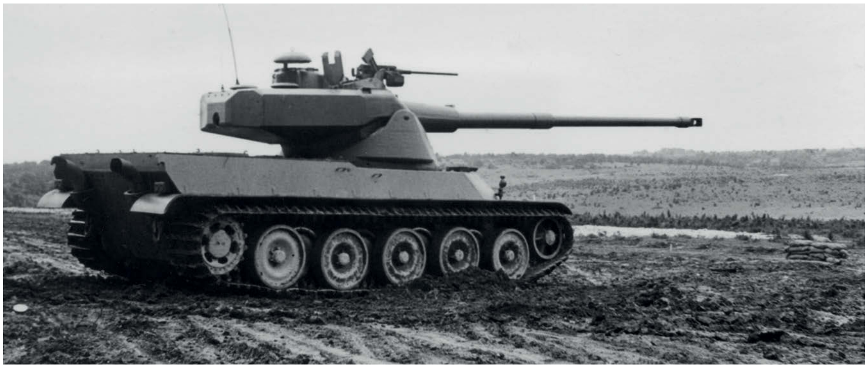
The hull and automotive components of Conqueror were based on the earlier A45 design for a Universal Tank to replace both Cruiser and Infantry types. Since a completely new turret had to be designed for Conqueror, the existing hull was fitted with a Centurion Mark 3 turret for mobility and reliability trials under the designation FV 221 Medium Gun Tank Mark 1 Caernarvon. The first Caernarvon was completed in April 1952 and ten vehicles were built of which seven were later reworked to Conqueror Mark 2/1/H standard.

The well-sloped frontal armour of the glacis plate was equivalent to 330mm in thickness, which had never been achieved in any previous tank design.

The appearance of the IS-3 was all the more notable since American armour was represented at the victory parade by the M24 Chaffee light tanks of the 16th Mechanized Cavalry Group and British by the Cromwell A27M Cruiser tanks of the 7th Armoured Division: both armed with a 75mm gun of limited armour-piercing capabilities against the Tiger tanks. The only western tank of any comparison to the IS-3 was the M26 Pershing armed with a 90mm M3 gun and weighing the same as the Russian tank. All the western powers recognized that the IS-3 and any potential successors represented a significant threat due to the performance of its heavy-calibre main armament, a weapon that had become dubbed 'animal killer' in its ability to destroy Tigers and Panthers at long range.

The appearance of serried ranks of IS-3 heavy tanks at the Allied Victory Parade in Berlin on 7 September 1945 caused consternation among the Western Powers as they had nothing to compare with this powerful machine.





The AMX 50 came in various configurations but the hull bore a distinct similarity to the wartime Panther and King Tiger, together with their torsion bar suspensions of overlapping roadwheels; indeed the AMX 50 featured the same Maybach HL295 engine as the King Tiger. Of particular note, the later AMX 50 prototypes featured an oscillating turret with an automatic loader. This is the AMX 50 Surbaissé that was built in 1956. It was armed with a 120mm gun and a roof mounted MG 151 20mm automatic cannon. The latter was to be fitted to production vehicles as a coaxial weapon. The AMX 50 project was terminated in 1959 in the same year as the T10M entered service. The French then placed their faith in the 105mm OBUS-G HEAT round to defeat heavy armour.

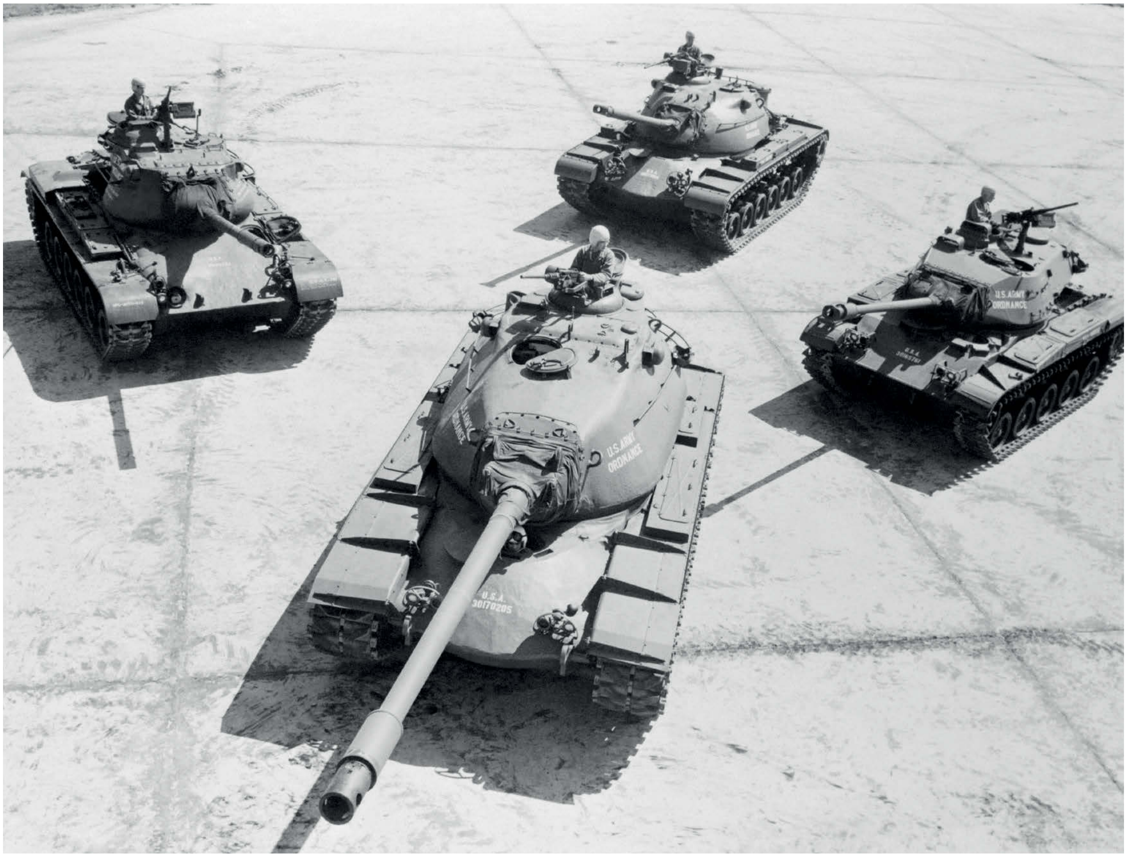
During the latter years of World War II, both Britain and the United States produced super-heavy tanks in the shape of the A39 Tortoise and the T95. Weighing in the region of 70 tons, these assault guns were intended to pulverize the heavy fortifications of the Siegfried Line on the western border of Nazi Germany. Neither saw action. Their development coincided with American work on a heavy tank designated T29, intended to counter the Tiger and Tiger II as well as putative future German designs. With the end of World War II, progress slowed and the first T29 armed with a 105mm gun did not appear until October 1947. Nevertheless, a further model armed with a T53 120mm gun, derived from the existing M1 120mm anti-aircraft gun, was developed under the designation T34. This was followed by the 120mm Gun Tank T43 that featured a cast hull and an elliptically shaped cast turret. Armed with a T122 120mm gun, the turret had a maximum armour thickness of 267mm and 127mm on the hull front. Given the size of the 120mm ammunition, the projectile and propellant were loaded separately, necessitating a second loader to serve the weapon.

With the outbreak of the Korean War in June 1950, the prospect of another world war loomed and the need for a tank able to counter the IS-3 became ever more urgent, but priority was given to the development of a new medium tank that became first the M47 and then the M48 Patton. In consequence, production of the T43 (now T43E1) did not commence until April 1956 with the designation 120mm Gun Tank M103, as the definitive counter to Soviet heavy tanks. In all, 300 M103 tanks were manufactured, with 80 going to the US Army and the remainder to the US Marine Corps. In January 1958, the US Army deployed the M103 to Europe with the 899th Tank Battalion, subsequently 2nd Heavy Tank Battalion, 33rd Armor. In the US Marine Corps, each of its three tank battalions was assigned an M103 company. From August 1963, 208 USMC M103 tanks were upgraded to the M103A2 standard with the Continental AVDS-1790-2A diesel engine. The 120mm Gun Tank M103 was withdrawn from service in 1973 having never seen combat.

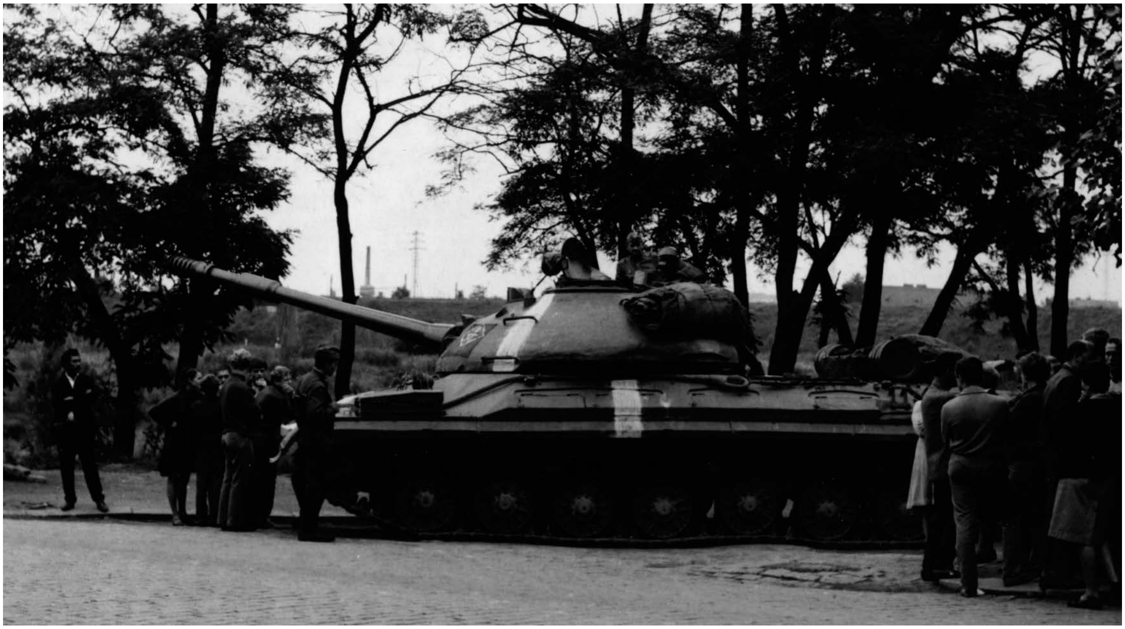
In France, the clandestine development of AFVs continued even under German occupation. After liberation in 1944, a series of experimental heavy tanks was produced, including the ARL44 Char de Transition; the M4 that closely resembled the Tiger II and the Char SOMUA SM armed with a 100mm gun in an oscillating turret. The latter became a characteristic of post-war French tank designs including the AMX 50 medium tank. Given the damage to French industrial infrastructure wrought by the Nazis and Allied bombing, it was remarkable that a prototype of the AMX 50 was produced by the autumn of 1949. The tank was originally designed with a 90mm gun but subsequent prototypes featured a 100mm in 1950 and finally a 120mm gun in 1954 that was capable of firing the same ammunition as the M103. In the following year, the design was refined with heavier armour in response to the perceived threat of Soviet heavy tanks to become the AMX 50 Surblindé or 'Up-armoured', but the tank now weighed some 64 tons that was deemed too heavy. This version of the AMX 50 was redesignated Char Lourd or Heavy Tank.

Therein lies the dilemma that faces every tank designer. Greater firepower requires a larger gun that in turn demands a bigger turret and hull. The more armour that is added necessitates a more powerful engine that entails greater internal volume within the hull and yet more weight. Hence the vicious spiral continues. The design of the AMX 50 was heavily influenced by that of the Panther and Tiger II. Furthermore the French army had two regiments of Panthers in service at this time. These tanks were powered by the Maybach HL 230 engine which was also used in the ARL 44. A more powerful version, the HL 234, was developed for the Tiger II raising the output from 700 to 900hp by means of fuel injection. This was the model chosen for the AMX 50, but such horsepower was still insufficient for a tank weighing 64 tons. Fortuitously, the Maybach factory in Germany was in the French zone of occupation, so its engineers were co-opted by the French to develop the engine further as the HL 295 with an output of 1,000hp. This proved to be impossible and the AMX 50 never entered production. Development ceased in 1958 at the behest of the newly installed President Charles de Gaulle.

In the same year the definitive model of Soviet heavy tanks was introduced, the T-10M (the IS series designation had been changed after the death of Iosef Stalin in



The 120mm Gun Tank M103 was the American answer to the menace of the IS-3 and T10 series. With a maximum armour thickness of ten inches, the M103 had a crew of five including two loaders to serve the M58 main armament with the 33 rounds of 120mm ammunition carried. The M103 is shown here with the family of US tanks developed during the 1950s with the 90mm Gun Tank M47 at left; the 90mm Gun Tank M48 and the 76mm Gun Tank M41 at right. (Getty Images)



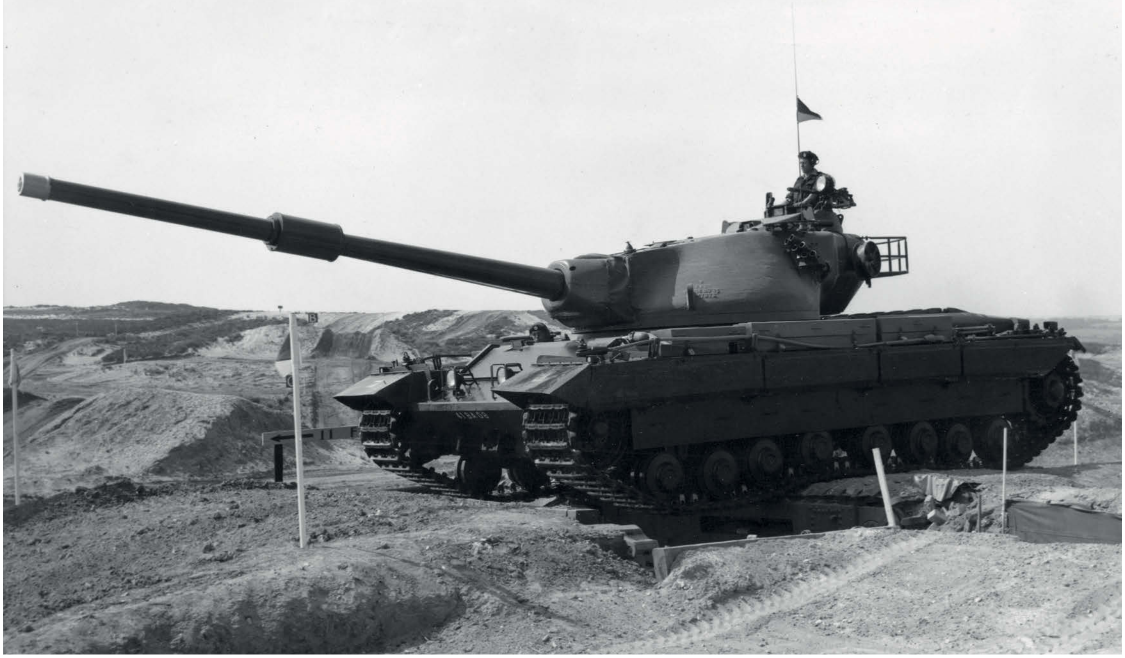
The T-10M was the final model in the IS-3/T-10 series. It featured a longer M-62-T2 L/46 gun with its characteristic five-baffle muzzle brake, together with infra-red night vision equipment and an NBC protection system. Some 6,000 Soviet heavy tanks were manufactured after 1945 of which 1,439 were T-10s. Production ceased in 1966 and it remained in service until 1996. No T-10s were exported to Warsaw Pact countries or other Soviet client states and it was only used operationally to crush the Prague Spring in Czechoslovakia. This T-10M is shown on the streets of Prague on 21 August 1968 on the day after the Soviet invasion with a spare final drive unit on the rear engine decks in case of breakdown.

1953). The tank was armed with a new and more potent M-62-T2 122mm gun enhanced by a full, but complex, stabilization system and infra-red (IR) night fighting equipment as well as nuclear radiation protection. A total of 1,079 T-10M tanks was manufactured between 1958 and 1964. It is significant that neither the AMX 50 nor the M103 had any of these features; nor did the British equivalent, the Conqueror. As stated above, urgent measures had been taken by the British Army to address the menace of the IS-3. The initial response was to up-gun the Centurion tank to Mark 3 standard with the Ordnance QF 20-pdr gun (84mm or 3.3in). With a muzzle velocity of 1,465m/s (4,810ft/sec), the 20-pdr was able to defeat 330mm of rolled homogenous armour (RHA) at 1,000 yards when firing the APDS Mark 3 round: 330mm being the exact equivalent thickness of the glacis plate of the IS-3. Further weapons were mounted on the chassis of the Centurion including 120mm and 180mm guns as improvised tank destroyers. In particular, experiments were undertaken with the new British High Explosive Squash Head (HESH) projectile to determine its efficacy as an anti-tank round at long range. It proved highly effective and HESH remains a favoured battlefield round with the British Army to this day.

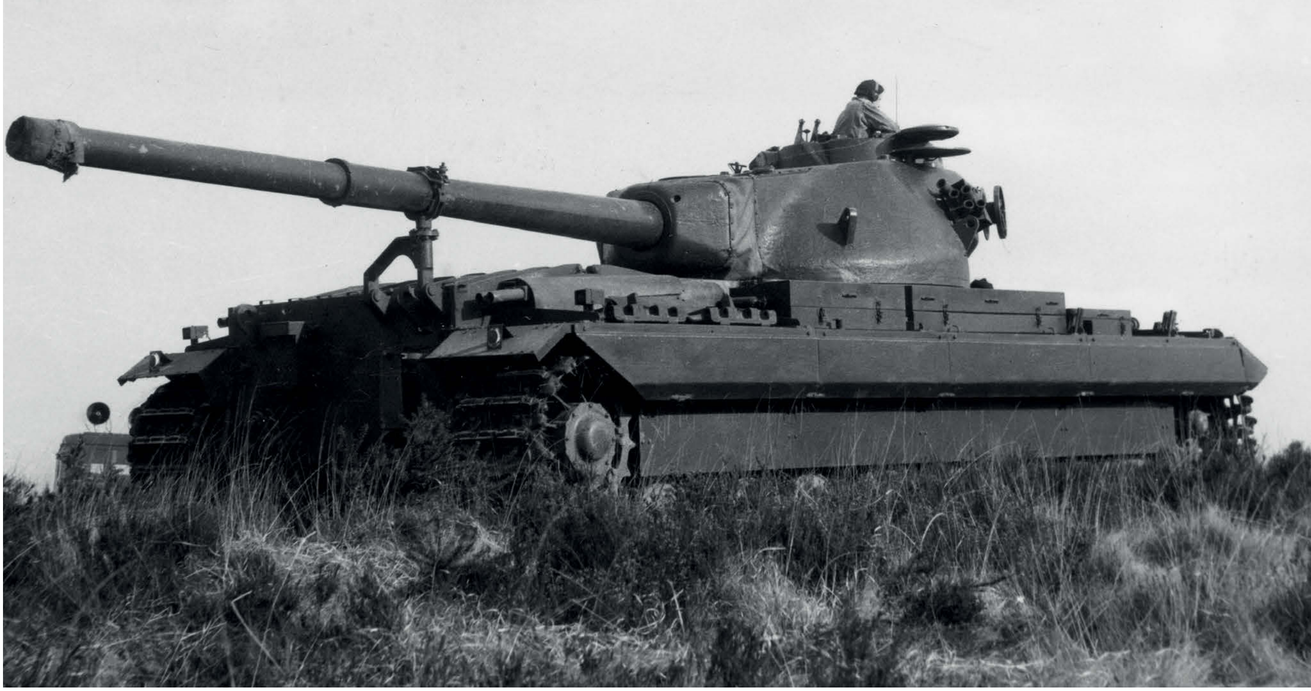
The concept of a ‘Universal Tank’ based on the FV200 series was abandoned in 1948 due to a variety of reasons and its special purpose variants in the following year. Nevertheless, the perceived threat of the IS-3 remained and the need for a heavily armed AFV to counter it was recognized with the requirement for the Heavy Gun Tank FV214. The tank was to mount the same 120mm gun as the M-103 but firing British ammunition, although it was capable of using American rounds. Since the hull and automotive components were a refinement of the FV201 gun tank, only the turret and weapon installation had to be designed from scratch. The design parent for the project was the English Electric Company. In the interim, experience of operating such a large AFV was gained by fitting a Centurion Mark 3 turret on the putative hull of the FV214. This combination was designated FV221 Medium Gun Tank No.1, and Caernarvon and Vickers-Armstrongs completed the first one in April 1952. The company also produced two prototypes of the FV214 with one in mild steel and the other in armour plate. A further 20 pre-production models were manufactured at Royal Ordnance Factory (ROF) Dalmuir near Glasgow. These underwent troop trials in BAOR between April 1955 and April 1956 and were then designated Tank, Heavy No.1, 120mm Gun, FV214 Conqueror Mark 1. A further 165 Conquerors were built as the Mark 2 version together with 28 FV222 Armoured Recovery Vehicles. The production of Conqueror ended in 1959.

From the outset, Conqueror was intended for the destruction of enemy armour at long ranges. At the time tank-vs-tank engagements were rudimentary, and little-changed from World War II. Range estimation to target relied on the Human Eyeball Mark 1, followed by a High Explosive shell at the appropriate setting. If the range was correct, the gunner then made the necessary adjustments for firing armour-piercing rounds. After the Normandy campaign, tank-vs-tank combat was the exception rather than the rule. Most Allied tank casualties were caused by hidden anti-tank guns, both towed and self-propelled, as well as the ubiquitous provision of handheld infantry anti-tank weapons such as Panzerfaust and Panzerschreck. The optical sighting equipment of Centurion was a significant advance but was optimized for engagements out to 1,500 yards. However, in order to utilize the long-range capability of the L1 120mm gun, a more sophisticated fire-control system was necessary for Conqueror.

This was achieved by the provision of a commander's fully rotating sub-turret incorporating a coincidence rangefinder for more accurate range estimation: a method also employed on the M103. In essence, the commander was able to observe for targets independently of the position of the turret. Once the target was acquired, the commander then used the coincidence rangefinder to determine the range. This data was then transferred to the gunner's sight by the mechanical alignment of the sub-turret and main turret. The gunner then made the final laying adjustments according to the type of ammunition used and engaged the target. Meanwhile, the commander was free to acquire another target and so the engagement continued.



A Conqueror Mark 2 displays its trench crossing capability during a demonstration at Bovington. Readily apparent is the commander's separate Fire Control Turret or FCT with its coincidence rangefinder to enhance target acquisition beyond 1,000 yards. The FCT was capable of independent traverse to the main turret so allowing the commander to search for targets without moving the main turret thus revealing the tank's presence when in a hidden fire position. Once the commander had determined the distance to target, the information was automatically relayed to the gunner who then undertook the actual fire engagement.

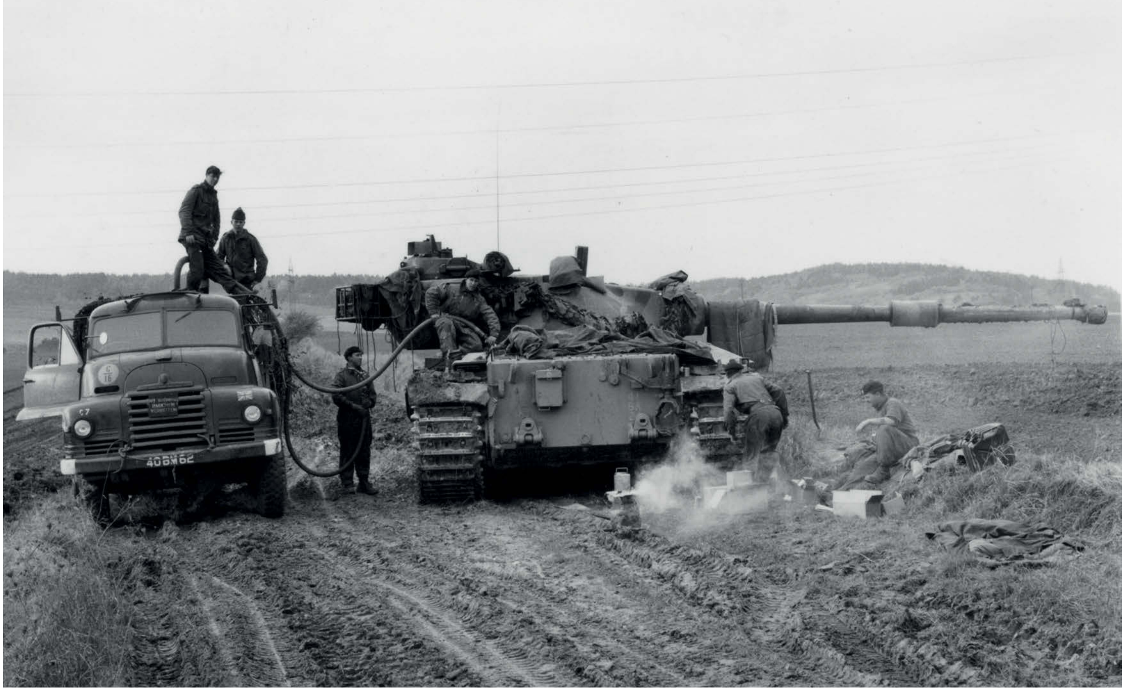


At 65 tons, the Conqueror was surprisingly mobile thanks to its M120 No.2 Mark 1A V12 810bhp petrol engine that was derived from the Meteor of Centurion. The increase in power was due to the use of fuel injection giving greater thermal efficiency per cylinder. A generator driven by the main engine or by a 4-clyinder 29bhp auxiliary engine when the main engine was not running provided electrical power. It was common practice to motor with the main armament in the gun crutch to minimise wear and tear on the stabilisation system.

This was the progenitor of the 'hunter-killer' principle used by all modern battle tanks. Unfortunately, the original device was manufactured by a supplier to the Admiralty whose rangefinders are designed for naval engagements as far as the horizon. Accordingly, such coincidence devices often had a base separation of the optical viewing heads of up to 10m; the wider the separation, the more accurate the range assessment. In the Conqueror, the separation was just 49cm and initially accuracy was poor. This problem was resolved in the Conqueror Mark 2 by fitting an alternative mechanism developed by the company of Barr & Stroud, which had been making rangefinders for the British Army for generations.

It is stating the obvious to say that the 120mm round of the L1A1 gun was heavy and unwieldy. The combined weight of a HESH round and propellant charge was 78lb (36kg) and for APDS 64lb. Accordingly, the brass cartridge case and projectile were loaded separately; even so, the loader's task required considerable strength and endurance. By choice, loaders were chosen for their physique but this was not always possible. One of the unusual features of Conqueror was an electro-mechanical device to dispose of the spent cartridge case through a hatch in the side of the turret – see 'A User's View' below. The Molins ejector system became notorious for its unreliability and a potential hazard to the turret crew. Curiously, it was built by the Molins Machine Company, whose core business was the manufacture of cigarette rolling and packaging machinery as well as cigarette slot machines. There is of course a considerable difference between ejecting a heavy brass cartridge case and dispensing a packet of cigarettes, but it was an innovative solution to a significant ergonomic problem within the cramped confines of a tank turret. On account of their size, a maximum of 35 rounds of APDS and HESH were available in Conqueror. This compared to 28 rounds in the IS-3.

The armour protection of the Conqueror over the frontal arc was without precedent for a British tank, with a maximum equivalent thickness of 178mm on the turret front



Conqueror Mark 2 41BA24 is replenished with 221 gallons of 80-octane petrol from a 'Roundnose' Bedford RL bowser during an exercise in West Germany. The Rolls Royce M120 engine gave a power to weight ratio of 12bhp per ton while fuel consumption was commonly two gallons to the mile on roads and at least three cross-country. For various reasons the Conqueror never realised its full potentiality nor did it achieve the original design concept of being a Universal Tank. Like so many Conquerors, 41BA24 ended up as a hard target on a tank gunnery range.

and a glacis plate of 130mm at 60 degrees: the fundamental requirement being to defeat armour-piercing projectiles of the Soviet T-54's 100mm D-10T tank gun. The well-shaped turret comprised a single armour steel casting with a separate welded roof plate. It featured a distinct rounded bustle at the rear where the commander's fire-control turret was positioned. Overall, the Conqueror weighed 65 tons and was the heaviest tank to enter service with the British Army up to that date. Mobility was provided by an uprated version of the Meteor engine as used in Centurion. Known as the Meteor, the M120 No.2 Mark 1A, 12-cylinder, liquid-cooled OHV petrol engine developed 810bhp at 2,800rpm as against 650bhp for the Meteor. This increase in horsepower was achieved by fuel injection in a similar manner to the Maybach HL 234 of the AMX 50. Despite Conqueror's weight, this provided a maximum speed of 21.5mph with a cross-country agility comparable to Centurion.

Conquerors were allocated on a basis of nine to each, but not all, armoured regiments in BAOR. There was no clearly defined standard of issue so it was down to each regiment to decide how Conquerors were to be employed. Some distributed one to each troop or had a dedicated Conqueror troop of three within each squadron. The latter proved to be more effectual since all corporate knowledge was concentrated in one place. Therein lies the crux of the Conqueror saga. Since it was considerably more complex than Centurion, Conqueror required a dedicated crew of highly trained personnel, but at the height of National Service such experience was spread thin across the Royal Armoured Corps. Accordingly, its higher servicing requirements were often neglected, resulting in unreliability. A doctrine for Conqueror's employment was never fully realized, beyond being in overwatch to provide long-range fire support to Centurion formations. This more often than not required hull-down fire positions that in turn needed significant engineer commitment, but the Sappers lacked the bulldozing capability in the frontlines to undertake it. Further problems were encountered with Conqueror's strategic mobility both by road and by rail due to its weight and width, while many bridges were unable to bear the bulk of a Conqueror on a tank transporter. Following the introduction of Centurion, armed with the outstanding L7 105mm gun, Conqueror's role became redundant and it was withdrawn from service in 1966. Thereafter, Conqueror's career ended in ignominy as a hard target on gunnery ranges and few survive today.

A USER'S VIEW

John McClintock served with the Scots Greys and was a gunnery instructor on Conqueror. He was also qualified on the 2-pdr (Daimler armoured car), 20-pdr and 105mm (Centurion) and 120mm (Chieftain and Conqueror) guns so his experience is second to none:

'The Conqueror was hastily developed to address the problem of the Iosef Stalin 3, possibly on a false premise. This was a form of 'Tiger Terror' as happened in Normandy. It was not intended to be a 'battle tank'. It was intended as a 'support tank', primarily a tank destroyer. Early attempts to incorporate the Conqueror into Centurion troops were unsuccessful. They proved to be unwieldy in this role. When they were formed into Conqueror or heavy troops, they were much more flexible and successful. Basically, when the Centurions ran into 'trouble', the Conquerors could be called forward in support. In a defensive position, they would have been formidable.

'The Conqueror differed from the Centurion in several important aspects. It was much better armoured, weighing in at 65 tons. It had greater firepower, having a long-barrelled, high-velocity gun with a calibre of 120mm as opposed to the Centurion's 84mm. It fired, in addition to armour-piercing shot, squash-head (HESH) ammunition. This was relatively new and much more effective than the Centurion's high-explosive (HE) ammunition and critically, it had a devastating anti-armour capability. The Conqueror appeared to have been designed around its gun rather than the apparently former British habit of designing the tank then finding a gun to fit into it.

'It was more complex and benefited greatly from an all-gunner qualified turret crew as a result, if this could be achieved. Ammunition was very large and heavy. As result, it had to be loaded in two parts, the projectile followed by the cartridge case. This slowed the rate of fire. The size of the ammunition also reduced the amount that could be carried to 30 rounds. Frequent replenishment would have been necessary, in action. The two different projectiles had different cartridge cases. Mixing them up would have had a significant practical effect.

'The gunner was alone with the loader in the main turret, the commander having been relocated into a small, self-contained fire control turret (FCT), at the rear. The gunner's controls were similar to the Centurion. However, he was now seated adjacent to the rear of the breech. This exposed him to hot gases as the breech opened on firing and it was said that there could be a 'flash back' if these gases ignited on exposure to the atmosphere. I never experienced the latter problem. To guard against this, the gunner had a transparent plastic shield for his protection.

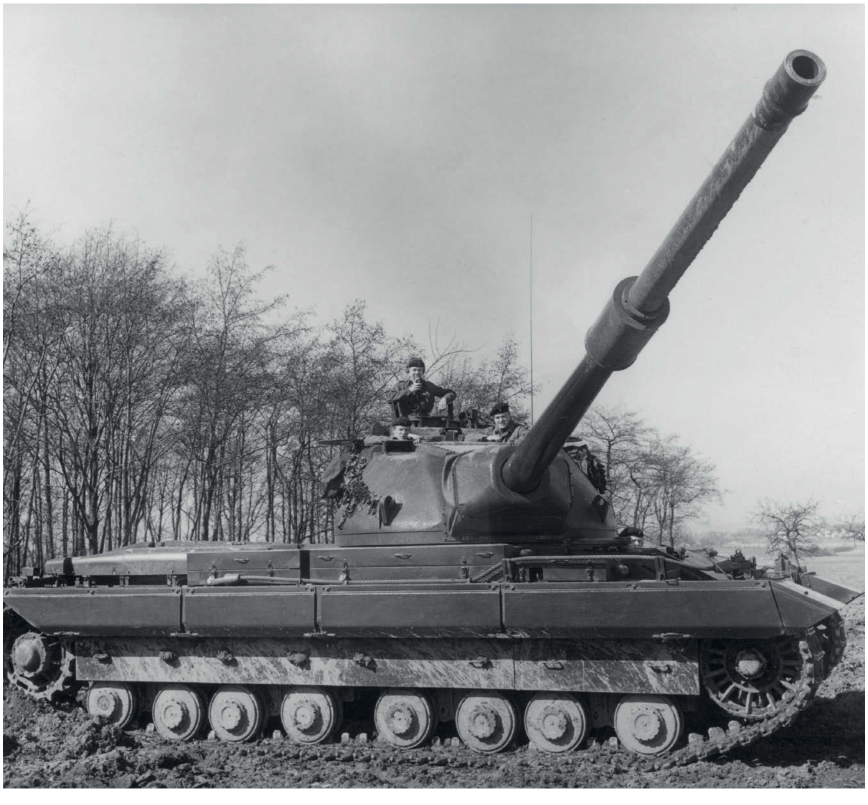
'Shell cases were very large and the Conqueror was provided with an automatic ejection gear. The empty case would be ejected from the gun and drop into a device that initially stood it upright then propelled it up a chute, opened a door in the side of the turret, threw it out and returned to its normal state, ready for the next case. It was a very useful piece of equipment but lacking regular attention, it could be unreliable. I ensured that it always functioned perfectly by daily testing.

The Conqueror entered service in BAOR in 1955 and was issued to armoured regiments with one in each tank troop or as a troop within an armoured squadron. The armour protection was formidable with the sloped glacis plate being 7 inches (178mm) thick while the turret front was 150 to 170mm thick and the gun mantlet at 200mm. Such heavy armour gave rise to a combat weight of 65 tons that severely compromised its strategic mobility on roads and rail. At a tactical level many bridges were too weak and understressed to bear a tank of such weight. The Conqueror was withdrawn from service in 1966.

'The principal departure from the 'norm' with the Conqueror, was the inclusion of the commander's sub-turret. It was a small capsule at the rear of the large turret. It could be rotated through 360 degrees, as could the main turret, from which it was independent. It was provided with its own Browning machine gun, sighting gear for that gun and a generous supply of ammunition. The commander could override the gunner's controls, if required. He could also set the range on the gunner's range scale. The commander could scan by rotating his sub-turret, find a target, lay his sighting gear on to that target and set the range on the gunner's range scale, without disturbing the main turret. He could lock them together if he chose. This enabled a high degree of concealment to be achieved. He could even 'cut the range' onto distant targets by use of a small range finder. Having acquired the range, the commander could lay the main gun onto the target with the range already set. He could not however, for safety reasons, fire the gun. That had to be the gunner, with proper consideration for the loader, who could be 'in harm's way' if the gun fired without warning.

'In practice, the commander would find a target, lay his sights onto it, decide upon the type of ammunition appropriate and set the range for that ammunition on the range scale. This took only a matter of seconds. By pressing a switch, the gun would immediately adopt the correct elevation and the turret would spin into the line of sight and end up 'on target'. Before pressing that switch, which could initiate violent movement, the crew, including the driver, had to be warned by the command "Line up, stand by. Sabot action! Fire when ready!" If the driver had his head out of his hatch, it could be taken off by the gun mantlet or the rear of the turret if the gun was over the rear. The loader would load the appropriate ammunition and when clear of the gun, operate a 'trip' (safety) switch then report, "Loaded!" To protect the loader, the gun would not fire until he had done this. When the gun was laid following 'Line up', the target would already be in the gunner's sight and only a minor adjustment would be required. He would in turn warn the crew 'Firing now', and fire. The Conqueror rarely missed but the gunner could make minor adjustments to range or line off his own back or the commander could initiate this by command, e.g. "Right half target add two hundred (yards), fire!" From sighting a target to firing took seconds only. A Conqueror commander had his 'work cut out'. On his head, as had all members of the crew, he had his headset. On his chest, he had a control unit-cum-mouthpiece, with which he communicated 1) with the crew, when switched to intercom (internal communications), 2) to his Squadron frequency, when selected, to communicate with other tanks, and 3) paradoxically, and I believe that this was peculiar to the Conqueror, with infantry and artillery. This was something to do with its support role. How would the commander know who was calling him? The different arms, tank, artillery and infantry had a different tone in the headset. This role as Conqueror commander required a high degree of competence and experience and, preferably, gunnery experience.

'The Conqueror was the first British tank to enter service fitted with a range finder. Tuition in the use of the infantry range finder of the day, the Barr & Stroud, on a gunnery instructor's course, was more than sufficient to enable the use of the small range finder fitted in the commander's sub-turret of the Conqueror. In theory, it was a valuable addition to the tank's capability. In practice, it was hardly worth the expense of fitting it. It was only of value if the intended target was stationary. Hardly the case in a tank battle. Using it to determine the range of a tank coming at you at over 20 miles per hour was a nonsense. With the high velocity of the Conqueror's rounds, its use under 1,000 yards was highly questionable and probably a waste of



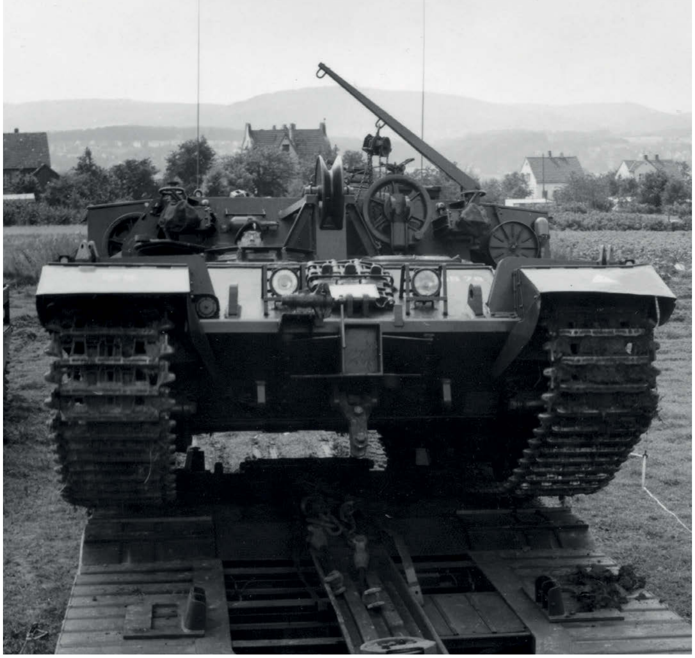
In its primary role as long-range tank destroyer, Conqueror was armed with the 120mm L1A1 that was derived from an American anti-aircraft gun. Fitted with a fume extractor half way down the barrel, the L1A1 initially fired two types of ammunition – APDS and HE. Subsequently, a High Explosive Squash Head or HESH round was issued and 35 rounds of ammunition were carried in the tank. Due to the size and weight of the ammunition, the round came in two parts with the projectile and the brass cartridge case propellant loaded separately. Suffice to say, the combination of 120mm APDS and HESH would have incapacitated any IS-3 or T-10 at normal combat ranges.

valuable time. On a stationary target over 1,000 yards, it could have some value but the fact was that an experienced gunner or commander acquired a rather accurate judgment of distance and in the interests of striking the first blow, it may have been advisable to 'shoot first' and if need be correct the range with the second shot rather than use up valuable time taking a range. In practice, the range finder was limited by its short base and was of little value over 2,000 yards, which was not really Conqueror territory.

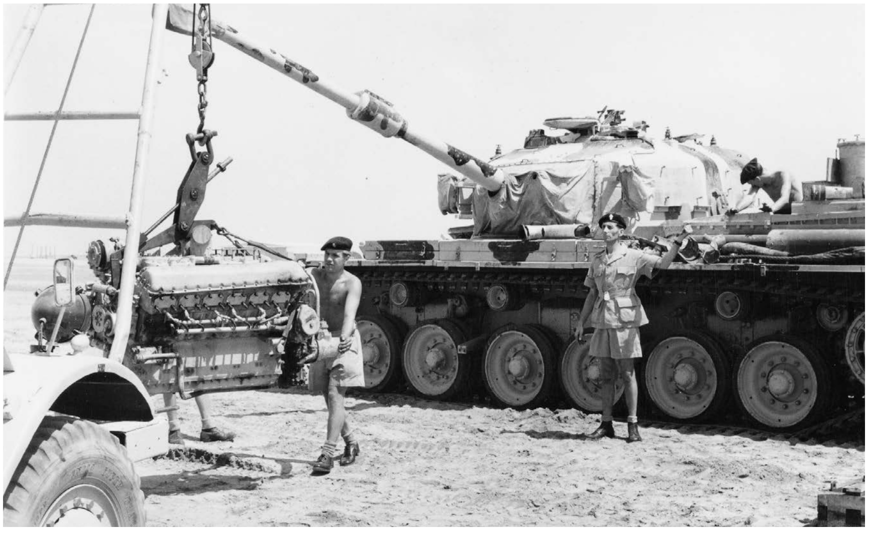
'However, in a defensive position, where time was available, the landscape ahead could be scanned for prominent indicators and the ranges plotted on a sketch plan. In the event of having to shoot, that would be a valuable source of information in estimating the range to a target in the vicinity of one of these prominent markers.

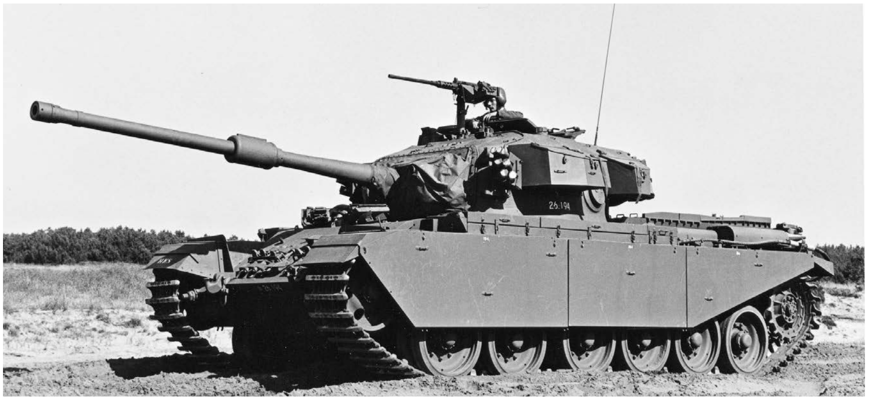
'The Conqueror's suspension system differed from that of the Centurion and was not generally approved of by Centurion crews. It had something to do with the weight of the tank. In practice, it was smoother 'across country' and enabled the tank to make better progress than the Centurion. There was much more space in the Conqueror and it was a more comfortable vehicle than the Centurion, which could be very cramped when fully loaded with ammunition and equipment. However, it had two shortcomings over which we had no control. If the gun was out of its travelling crutch, the turret could rotate. If the driver had his head out of his hatch, it could be struck, with serious consequences. If closed down, with the hatch shut, he was safe and had a good view through his vision 'episcope'. Problematically, if he had to get out in a hurry and the gun mantlet or the rear of the turret was overhead, there was no possibility of escape that way. He would have to go backwards into the turret and out of one of the turret hatches. If the tank was fully 'bombed up' with ammunition, this was a very difficult thing to do. I would drive a Centurion but I chose not to drive the Conqueror.

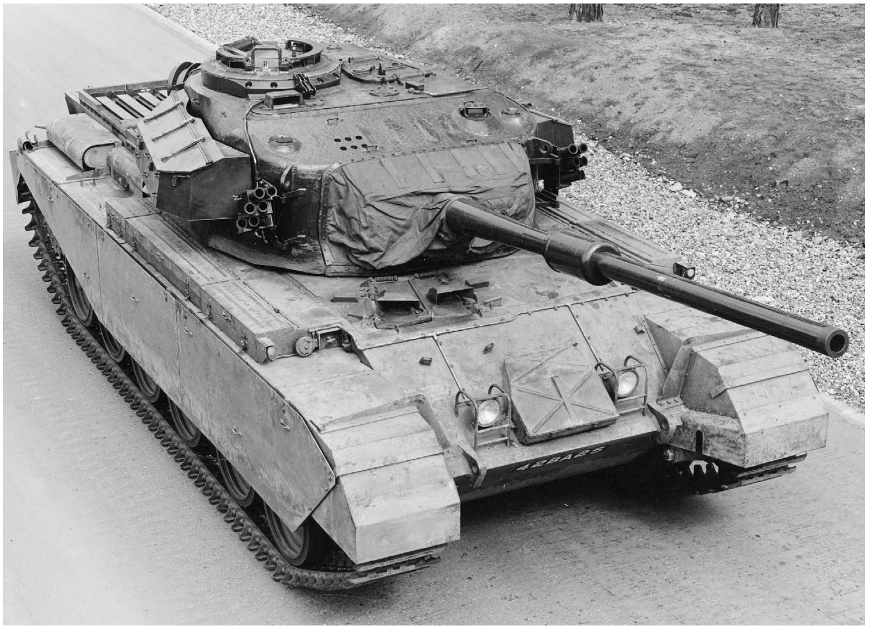
'Another significant problem with the Conqueror was its stabilizing gear. It was not designed to enable the tank to fire on the move, as the Centurion. It was designed to protect the gun trunnions (bearings) from excessive stress, due to the weight of the gun. It was very unreliable. Once the stabilizing gear engaged, the gunner had no control over it. On reaching the firing position and stopping, there was a significant delay before control was returned to the gunner, meaning that he could not lay the gun and fire, making the tank very vulnerable. A related fault frequently occurred when the gun was subsequently fired. The stabilizing gear took control away from the gunner, put the gun into maximum elevation and would not return control to the gunner. This was an electrical/technical fault over which the crew had no control and could not rectify. The tank was out of action until it received the attention of a skilled REME [Royal Electrical and Mechanical Engineers] fitter.'



One of the few variants to be produced in the extensive proposed FV200 series was the Conqueror Armoured Recovery Vehicle. It was produced in two versions as the FV219 ARV Mark 1 and the FV222 ARV Mark 2 with eight of the former built and 20 of the latter. Both types were immensely powerful machines and capable of recovering any AFV in the British Army's inventory. The ARVs continued in service long after Conqueror was withdrawn and were employed in various MOD establishments for a variety of tasks. One was even trialled at RAF Fairford to drag crashed B52 bombers from the runway in an emergency. This is an FV219 ARV mounting a tank transporter showing some of its extensive recovery equipment.



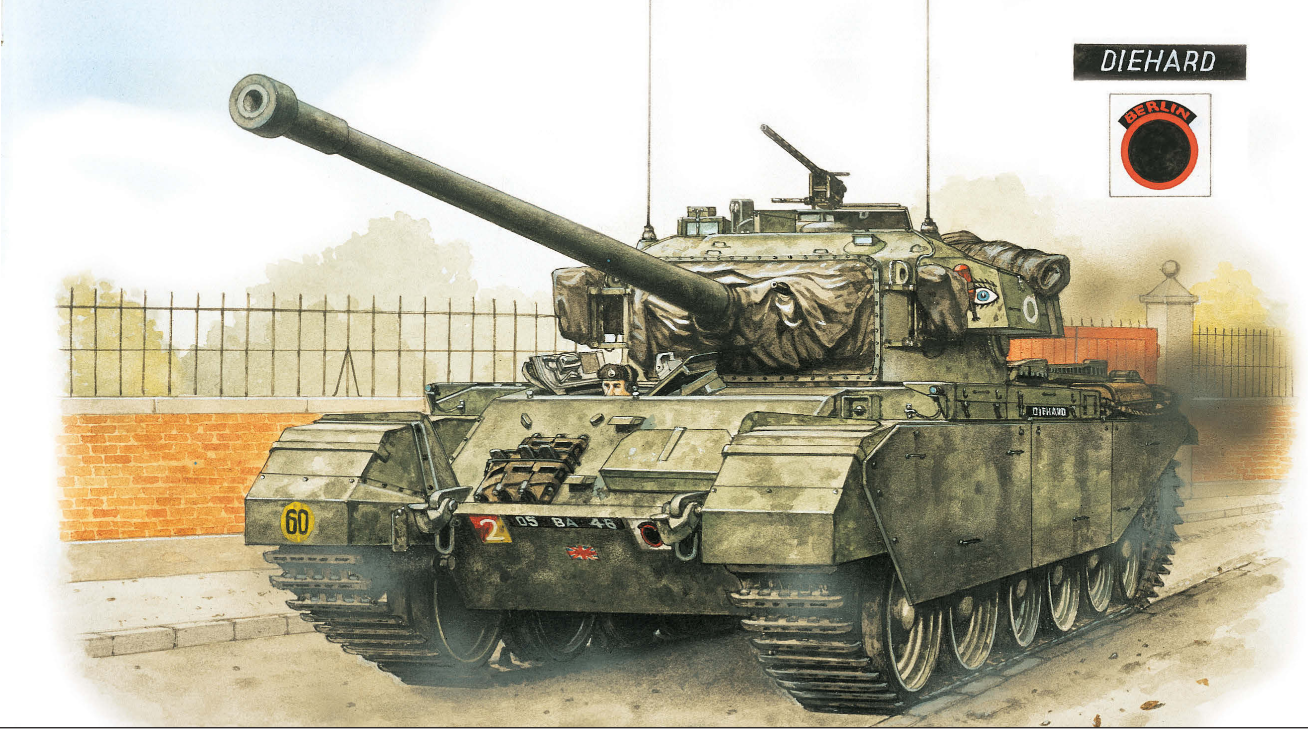




TOP One of the principal criticisms of the Centurion was its poor ease of maintenance although it was generally reliable and repairs simple once access to the faulty component was possible. For instance, it often took up to 18 hours to change an engine in the field and almost 12 in a workshop. This Centurion Mark 5 has the Type B 20-pounder gun barrel with a fume extractor to reduce the entry of toxic fumes into the turret when the breech was opened after firing.

MIDDLE The Centurion enjoyed considerable export sales during the 1950s with the majority being Marks 3 and 5. This Mark 5 belongs to the Royal Danish Army and has been modified with the addition of a .50-calibre Browning machine gun at the commander's cupola.

BOTTOM The Mark 7 represented a comprehensive redesign of the Centurion with an enlarged hull to accommodate a greater fuel capacity under armour and improve the tank's poor range. The vehicle incorporated numerous other detail changes and 755 were built between 1954 and 1959.



CENTURION MARK 5 OF 10 TROOP, C SQUADRON, 4TH ROYAL TANK REGIMENT, COMMANDED BY SERGEANT 'JAKE' JACOBS, WEST BERLIN, 22 AUGUST 1961

This Centurion Mark 5 with a 20-pdr A Type barrel is shown on the Bismarckstrasse in West Berlin during an alert following the sealing of the Soviet sector behind the Berlin Wall. C Squadron of 4th Royal Tank Regiment provided armoured support to the Berlin Independent Infantry Brigade Group. The colour scheme of overall US Olive Drab is peculiar to British military vehicles in Berlin during this period. On the left front trackguard is the bridging classification sign. Below the registration number on the lower front hull is the Union Flag common to all British vehicles in BAOR, distinguishing them from other NATO nations. The unit insignia and formation insignia of the Berlin Brigade appear either side of the registration plate 05BA46. The vehicle name 'DIEHARD' is painted on the sides of the trackguard stowage bins; tank names in 4 RTR have traditionally begun with the fourth letter of the alphabet. Another tradition is the 'Chinese eye' painted on the forward face of the turret stowage bins. It first appeared during World War I on a Tank Mark IV of F Battalion, which was paid for by a Chinese businessman. Later it was carried by tanks of 4th Battalion, Royal Tank Corps and subsequently by all tanks of 4 RTR. Other markings include the C Squadron tactical sign in white and the vehicle callsign, a plain white '2', on the black-painted jerrycan at turret rear. All of them were kept in immaculate condition, with such details as black-painted mantlet cover and alternate red/white striped radio aerials.

CONQUERER POSTSCRIPT

Like the Tiger tank in World War II, the IS-3 garnered a reputation far beyond its actual capabilities. From the outset, the IS-3 was a defective design with many faults beyond the fundamental problem of the appalling ergonomics of its interior, which was extremely cramped, particularly for the turret crew. The tank suffered from dreadful vibration that was very tiring for the crew but also caused the engine and transmission mountings to fail, requiring major repair. Wheel bearings burned out with monotonous regularity and hull welds failed, exacerbating structural integrity. Worse still, the turret armour cracked repeatedly and thus was vulnerable to any projectile strike. Overall reliability was poor and its radius of action inadequate. Indeed, newly built tanks were often sent directly from the Leningrad or Chelyabinsk factories to special plants to rectify the numerous problems. Thereafter many IS-3 were sent to long-term storage facilities and never issued to the armoured forces. In fact, production of the IS-3 was halted after less than a year with 2,311 built. Its successors fared little better, up to and including the T-10M series that emerged in 1959. The latter was the only one to be issued to units in GSFG (Group of Soviet Forces in Germany) and its single use 'in action' was during Operation Danube to crush the Prague Spring in August 1968. Yet the reputation of the IS-3/T-10 series transcended such difficulties, as the Western powers expended considerable resources in an arms race to counter them. However, the cost of their design, development, deployment and constant repair was horrendously high to the Soviet Union. By those lights the IS-3 was a limited success at the strategic level but no real match for Conqueror on the battlefield.

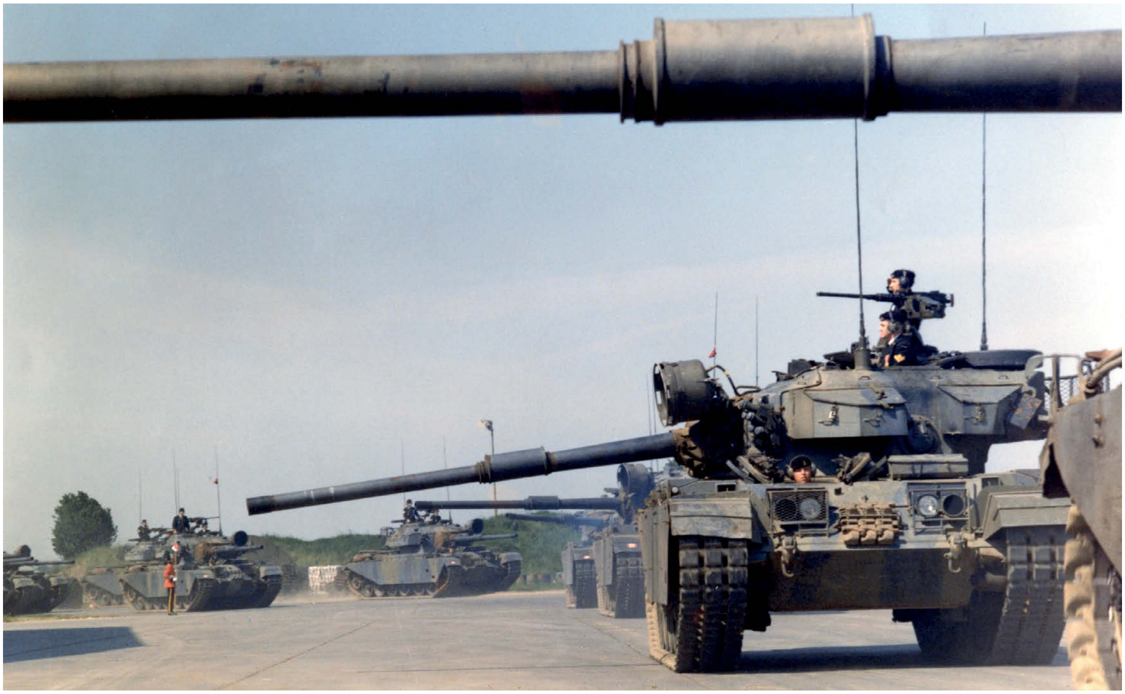
CENTURION EVOLUTION

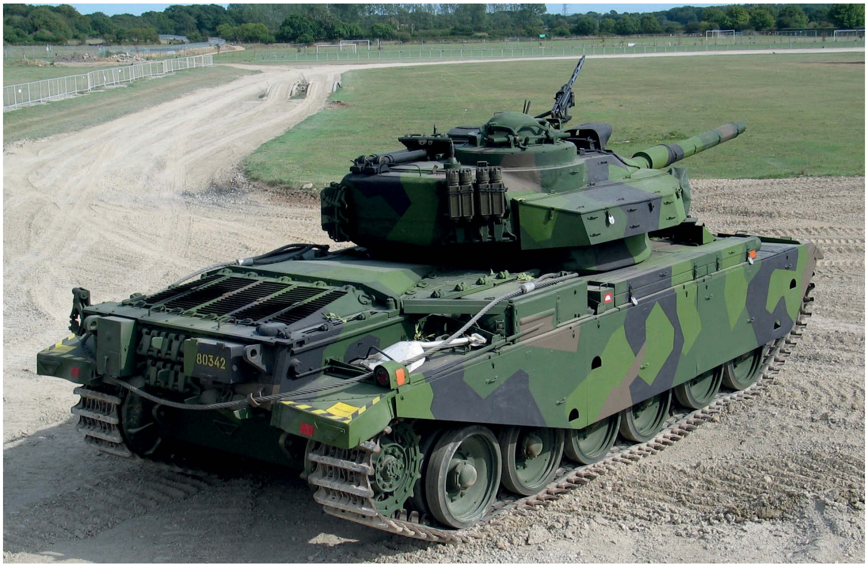
Although the Centurion had proved to be the outstanding tank of the Korean War, battle experience prompted several improvements and modifications, such as the removal of the loader's 2in Bombthrower and the relocation of his roof-mounted periscope. The most important change was the substitution of the 7.62mm Browning for the 7.92mm Besa as a coaxial machine gun. Not only was the Browning more reliable than the Besa but also 7.62mm was now chosen as the NATO standard calibre for small-arms ammunition. With this modification, the Centurion became the Mark 5 and it first appeared in 1955, with new-build production models in 1956. Other major modifications around this time included the fitting of a fume extractor to the 20-pdr gun and the introduction of a mono-wheel fuel trailer to improve the tank's inadequate operational range.

The 200-gallon armoured fuel trailer was not a success in service due to its excessive length, which caused problems when reversing or negotiating difficult terrain. Tank crews cordially loathed it. At the same time, a comprehensive redesign of the Centurion hull was under way to introduce a new model with a greater fuel capacity. Together with many other improvements, this became the Centurion Mark 7 and production began in 1954. One of the main differences was the use of UNF or unified screw threads and tools to conform to standardized American National standards. This followed a NATO requirement for greater 'interoperability' among the armies of the western alliance.

The performance of the Centurion during the Korean War had impressed the US Army and this led to the purchase of many Centurions by the US government to equip the armoured units of European NATO armies under the Mutual Defense Assistance Program. Indeed, the United States bought the second-greatest number of new Centurions after the British Army. Other major purchasers of Centurions during the early 1950s were Australia, Canada, India, South Africa, Sweden and Switzerland with minor users being Egypt, Iraq, Jordan, Kuwait, and New Zealand. In all, 4,423 Centurions were produced between 1946 and 1962. Among this list is one notable exception – Israel.

Over the years, the Israel Defense Forces (IDF) have been the largest user of the Centurion after the British Army. Almost a quarter of all the Centurions produced were acquired by the IDF and it remains in service as a heavily armoured engineer combat vehicle into the 21st century, over 60 years after the Centurion was first procured by Israel in December 1958. At first, the Centurion was unpopular in the Israeli Armoured Corps as it was much heavier and more complicated than the previous models they had used, such as the Sherman and the French AMX-13 light tank. During exercises in the Negev desert, the early Centurions suffered numerous



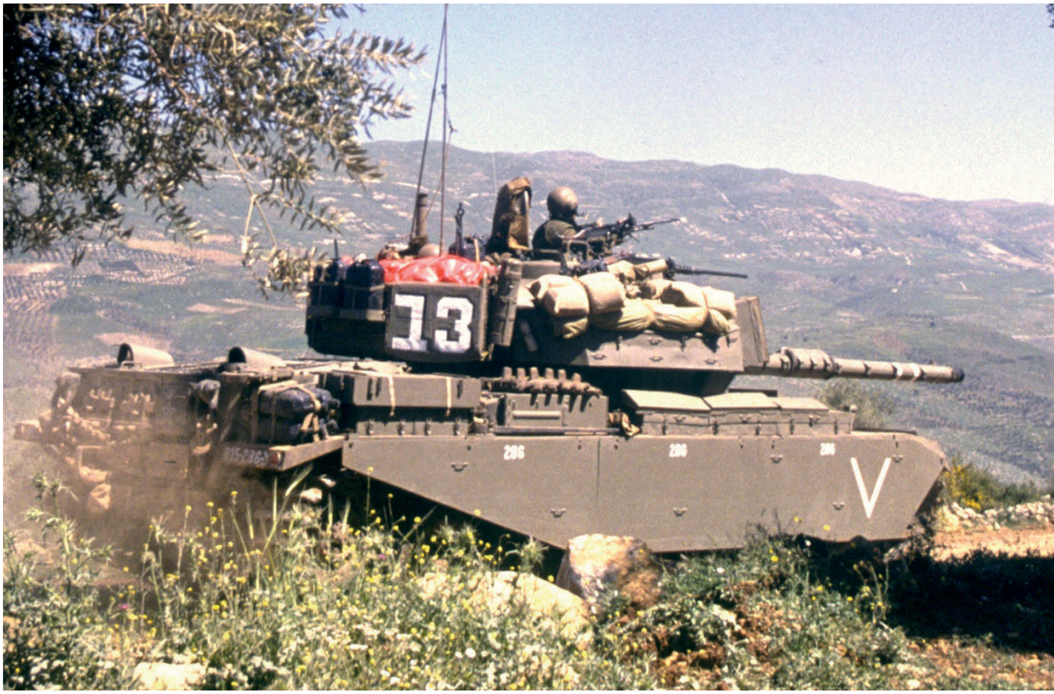


LEFT The Swedish army procured Centurion in the early 1950s and was the recipient of the final production models in 1962. All the gun tanks were progressively upgraded from the Centurion Mark 3 Stridsvagn 81 up to the Strv 104 with the Teledyne Continental/Allison powerpack, an advanced indigenous fire control system and reactive armour over the frontal aspect. The Centurion continued in Swedish service until 2000.

ABOVE The Centurions Mark 11 of The Royal Canadian Dragoon Guards dip their guns in salute during their final parade at Lahr in West Germany on 2 June 1977. Note the infrared driving and night-fighting equipment and the rubber-padded 'Hush Puppy' tracks.

mechanical breakdowns and the tank gained an unenviable reputation for chronic unreliability. Inefficient maintenance and poor training caused many of the problems.

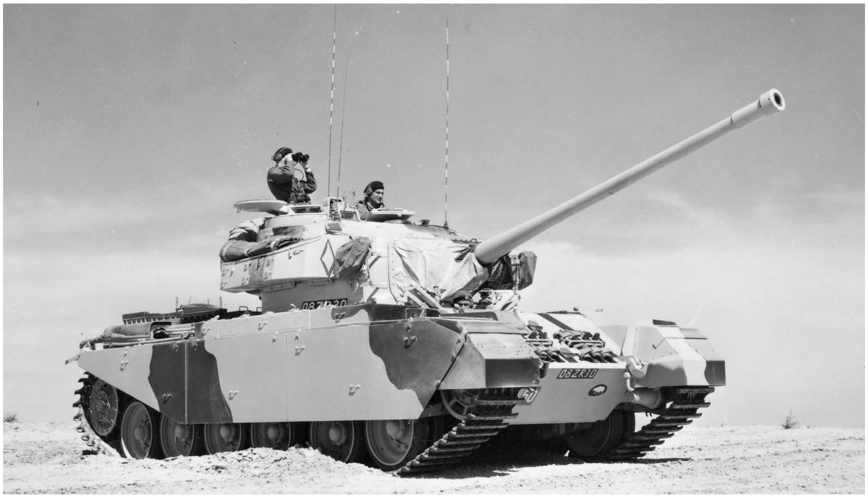
It was not until General Israel Tal became the commander of the armoured corps on 1 November 1964 that the Centurion was to vindicate itself. General Tal, a man of wide technical expertise and the strength of character to instil the discipline essential to the command of armoured formations and modern weapon systems, rigorously instituted strict maintenance procedures and gunnery training. Confidence in the Centurion rose dramatically. It soon proved its worth during the continuing battles along the Syrian border when the Centurion engaged and destroyed Syrian



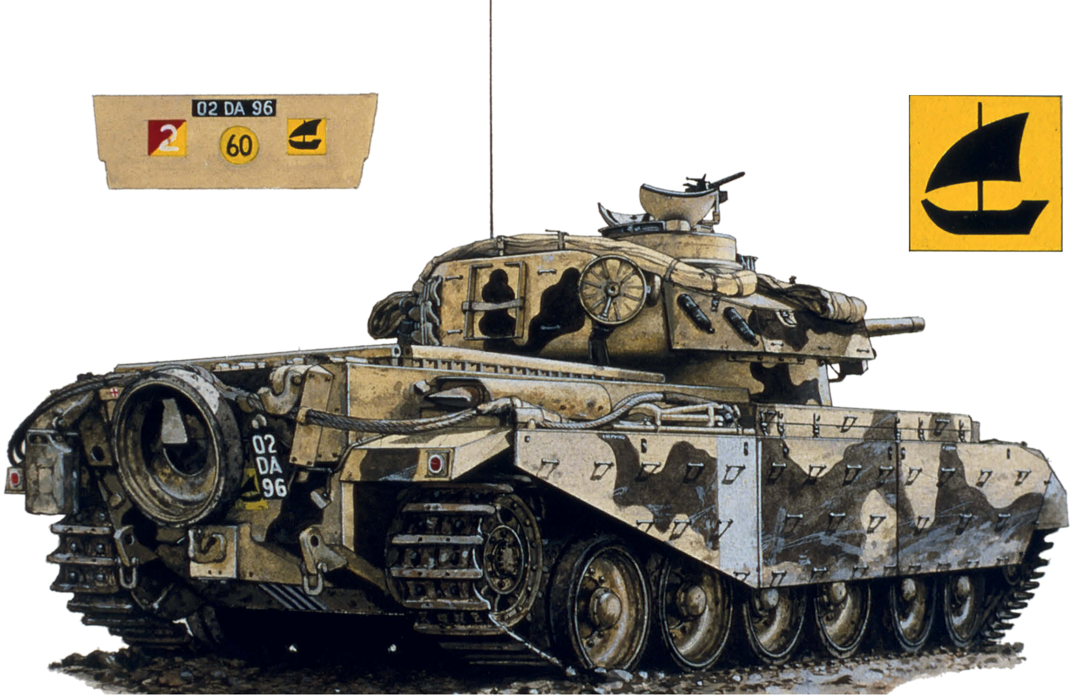
Named the Shot or Whip, the Israel Defense Forces have employed the Centurion since 1959 and, once it was superseded as a gun tank, the chassis has been employed as a combat engineer vehicle to this day. Thus, the tank has been in service for some 60 years as it has within the South African Armoured Corps (SAAC). The IDF was the first army to upgrade the basic tank with the classic combination of the Teledyne Continental AVDS-1790-2A air-cooled diesel engine and Allison CD-850-6 automatic transmission that provided much improved performance, reliability and ease of driving, while the fire control system has been greatly enhanced over the years as well. This configuration was followed by the SAAC and it is still employed as the Olifant Mark 1A, which remains a highly effective MBT in Sub-Saharan Africa.

tanks and engineering vehicles at extremely long ranges, thanks to the crews' new-found expertise in tank gunnery. It was soon to be put to dramatic effect during the Six Day War of June 1967.

At the outbreak of the conflict, the IDF had approximately 400 Centurions and they formed the spearhead of the three Israeli divisions in the overwhelming offensive that captured the entire Sinai Peninsula. After the ferocious and hard-fought breakthrough in the Gaza Strip against a tenacious Egyptian defence, the Centurions and M48 Pattons thrust onwards towards the Suez Canal. In the fluid battles that ensued, the Centurions' mobility and firepower proved to be second to none, while their ability to continue fighting after extensive battle damage made the Centurion highly regarded by their crews.



With her widespread empire and reliance on Middle East oil, the British Army had worldwide commitments with an armoured division stationed in the Libyan Desert for rapid deployment to the Middle East. This Centurion Mark 3 is camouflaged in sand yellow and black stripes.



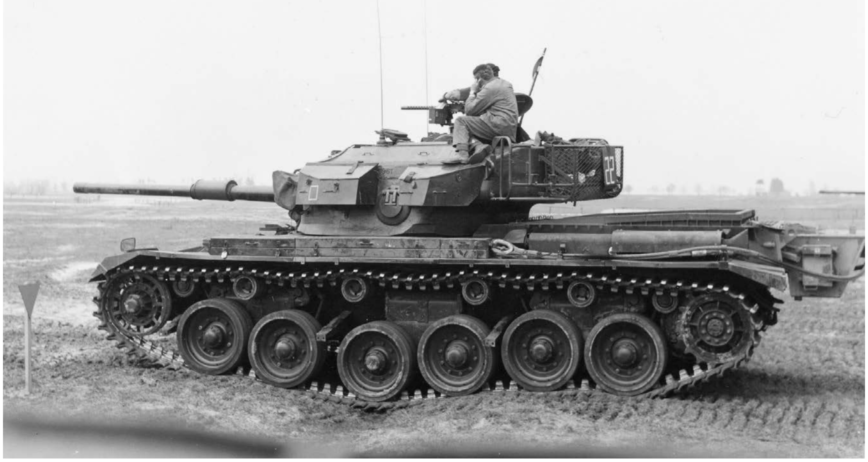
CENTURION MARK 10 OF 4 TROOP, C SQUADRON, 16TH/5TH LANCERS, COMMANDED BY CORPORAL FINNEY DURING OPERATION ARMADILLO'S DELIGHT, WADI MISRAH, RADFAN, 14 MAY 1964

The tank is finished in the standard camouflage scheme of sand yellow and black stripes common to British military vehicles based in Aden. At any one time one squadron of the resident armoured regiment served with the Royal Navy Amphibious Warfare Squadron, whose role was to patrol the Persian Gulf to meet any emergency arising in the area. One of the perennial trouble spots was the Iraq/Kuwait border and as the Iraqis were equipped with Centurion tanks a broad white band was painted on the rear bazooka plates of British Centurions as a recognition device. The tank's registration number 02DA96 at the top of each bazooka plate so that they are not lost among the many others that litter a tank park during maintenance sessions. On the rear hull plate, partly obscured by the spare roadwheel, is the unit insignia of a white '2' on the RAC flash, and the Black Dhow formation sign of the Aden Garrison. These markings are repeated on the lower front hull together with the bridging classification sign. The black and white convoy distance marker is just visible beneath the towing pintle. Beside the obvious need for extra water jerry cans when operating 'up country', the spare roadwheels were essential items in the Radfan where the appalling terrain shredded rubber tyres and distorted tracks to an alarming degree. Note the split hatches of the commander's cupola, characteristic of Centurions Mark 8, 10 and 13.

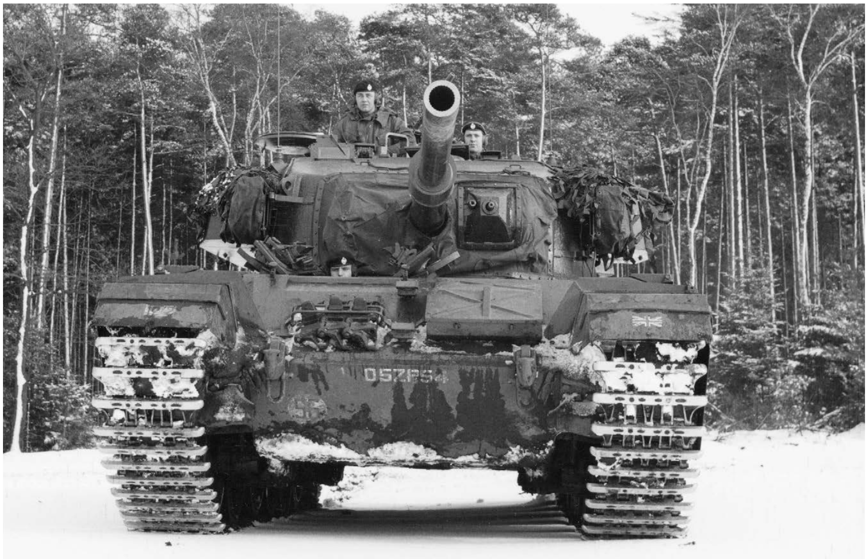
One of the decisive elements in the success of the Israeli armoured corps was the outstanding performance of the L7 105mm main armament of the Centurion. The design of this weapon began at the Armament Research and Development Establishment at Fort Halstead, Kent during the early 1950s, and the first trials were conducted in July 1956. During the Hungarian uprising in November 1956, the defence staff at the British embassy in Budapest was briefly able to inspect a Soviet T-54 captured by Hungarian patriots. This information dictated the performance requirements for the new weapon. The L7 105mm exceeded these with ease and it subsequently became the standard tank gun within NATO. Most armies around the world that were equipped with western tanks also adopted this superb weapon.

User trials of the L7 105mm gun were conducted in July 1959 and a single Centurion was built in the same year incorporating the gun on an up-armoured Mark 7 hull. This vehicle was produced to prove the viability of the L7 gun and a proposed up-armouring programme for the Centurion fleet. As early as November 1956, trials were conducted of a Centurion Mark 8 fitted with an additional 2in, or 50mm, of armour welded to the glacis plate. Both the up-gunning and up-armouring

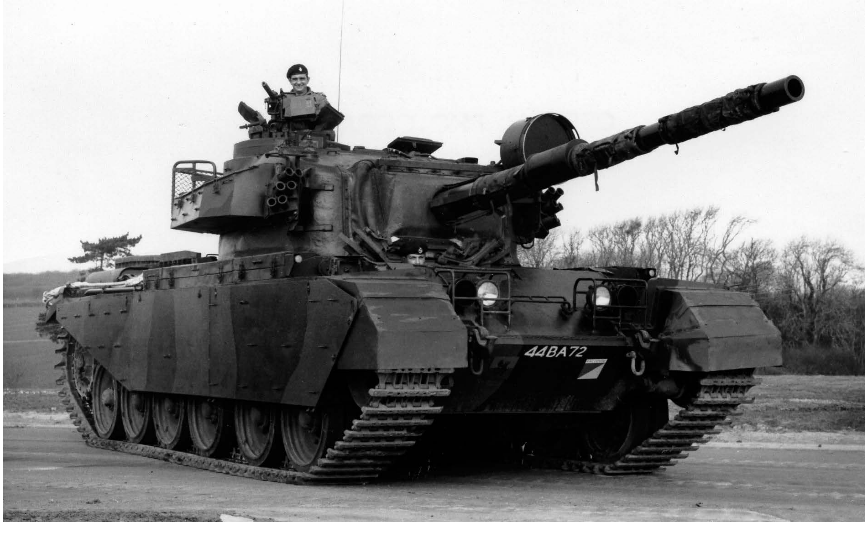
TOP The commander of a Centurion Mark 6/1 (LR) fires his .30-inch calibre Browning machine gun during a firing exercise on the ranges in West Germany during 1968. Mark 6/1 denotes the tank is equipped with infrared night fighting equipment – the 22-inch searchlight is visible stowed in the rear turret basket. The suffix LR stands for Long Range after the fitting of a 100-gallon armoured fuel tank to the rear hull plate.

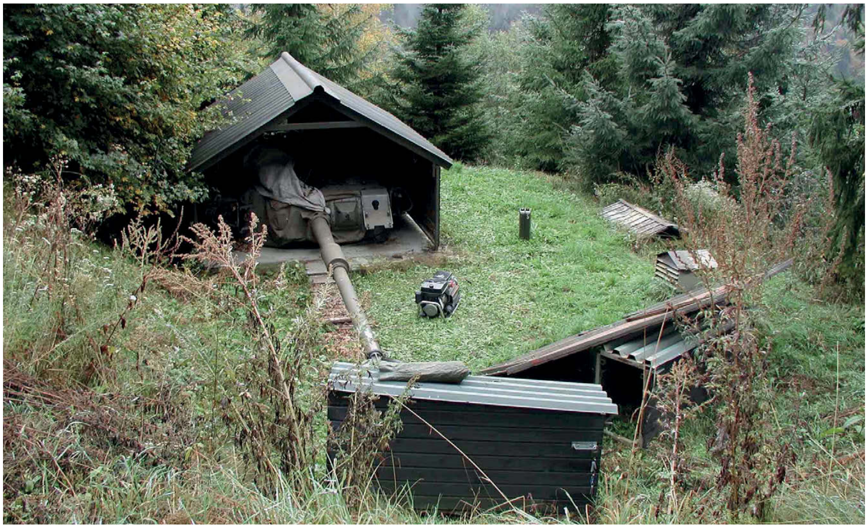


RIGHT A Centurion Mark 6/2 pauses during an exercise in West Germany during the winter of 1969. The Mark 6/2 incorporated a .50-calibre ranging gun; visible between the coaxial machine gun and the 105mm main armament.



The Centurion Mark 13 was the last model of the gun tank in British Army service. Originally manufactured as a Mark 8 or Mark 10, the Centurion Mark 13 featured all the late modifications such as infra-red night-fighting and driving equipment as well as a .50-calibre ranging gun and thermal jacket for the L7 105mm main armament.





LEFT and BELOW High in the Alps there are still Centurion tank turret emplacements disguised as mountain huts. From these domineering heights, they cover wide fields of fire over important avenues of approach combined with mined bridges and tunnels to deter any potential invader. This particular turret came from the Dutch army and is situated in the Austrian Alps.

programmes of the Centurion fleet were undertaken during base overhaul from 1959 onwards. These modifications altered the basic mark numbers, with the Mark 5 becoming the Mark 6, and Marks 7 and 8 becoming Marks 9 and 10 respectively. New-build vehicles had these features incorporated during production.

The next major modification programme was the introduction of infrared night driving and fighting equipment. A 22in searchlight mounted above the mantlet and aligned with the main armament provided infrared illumination for the gunner and commander. Depending on weather conditions, the system was effective in the active mode out to a range of approximately 500 yards. The main limitation was that any tank using IR apparatus in the active mode was readily visible to an enemy similarly equipped. Installation of IR equipment began in 1965 and this modification altered the vehicle designation with the suffix /1; thus a Centurion Mark 10 became 10/1. This applied to earlier marks as well.

The final modification programme of significance was the installation of the .50-calibre ranging gun from 1966. The ranging gun system offered a simple and accurate method of range finding compared to complex optical instruments. It was also potentially superior to the latter because of its ability to provide important ballistic data such as trunnion lilt and crosswinds. The ranging gun itself was a modified .50-calibre M2 Browning mounted coaxially in the mantlet. It fired three-round bursts of incendiary-tipped tracer ammunition, which ignited on hitting a hard object to indicate a target strike. The gunner observed the fall of the tracer rounds at the estimated range until they struck the target. He then transferred the range data to the chosen ammunition scale, be it HE or APDS, and the main armament was fired. At ranges above 1,000 yards, this system was faster than shell ranging but the ranging gun only had an effective range out to a mile. In its time, it was a simple and practical method of range estimation, though it required precise alignment with the main armament to be effective.

At the same time as the installation of the ranging gun, a thermal sleeve was fitted to the barrel of the L7 105mm gun to reduce the distortion of the main armament on firing, and so increase accuracy at long ranges. The adding of the ranging gun to Centurion altered the vehicle's designation and produced the final marks of the gun tanks. A standard Mark 6 with ranging gun changed to Mark 6/2; 9 to 9/2 and 10 to 10/2. Those tanks that had already fitted with IR equipment – Marks 6/1; 9/1 and 10/1 became Marks 11, 12 and 13 respectively. As a corollary, those Centurions Mark 6/2, 9/2 and 10/2 that were fitted with IR equipment also became Marks 11, 12 and 13. By now, a range of special-purpose variants based on the Centurion chassis that were designed to support the gun tanks on the battlefield was entering service.

CENTURION SPECIAL-PURPOSE VARIANTS

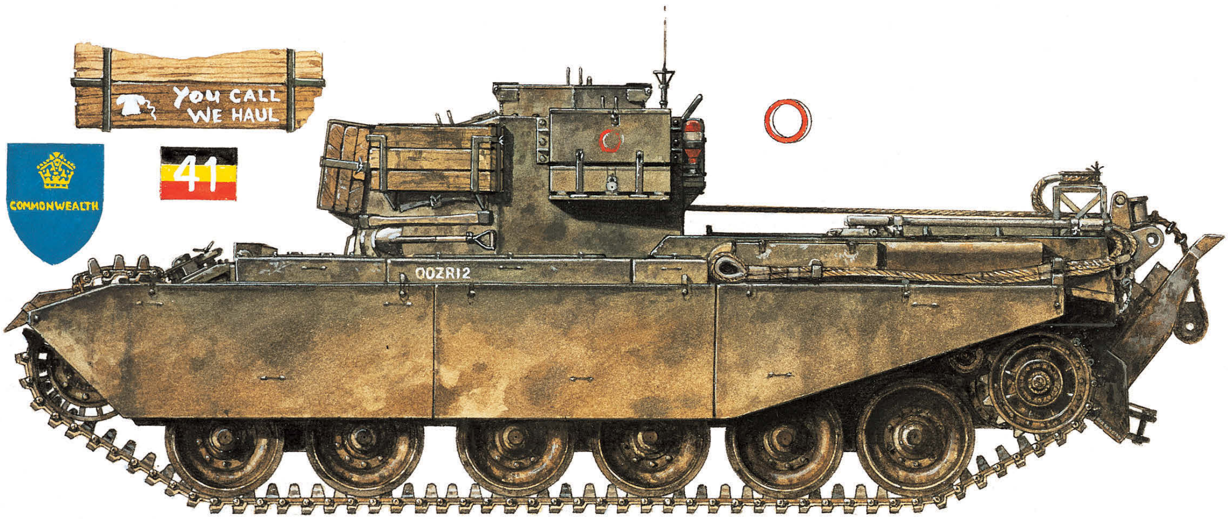
Following World War II, the A-series classification for tanks was changed to FV numbers, the FV standing for Fighting Vehicle. Thus the A45 Universal tank became the FV201 while the A41 Centurion was classified as the FV4000 series. As stated above, the FV201 Universal Tank and its family of special-purpose variants were cancelled in 1948 and 1949 respectively. The allocation of resources to the FV200 series delayed the design and development of special-purpose variants based on the Centurion chassis. The most pressing need was for a purpose-built Armoured Recovery Vehicle, or ARV, to support Centurion units. Experiences in Germany and Korea had shown that the wartime Churchill ARV Mark 2 was too slow and unreliable. As an interim measure, several Centurion gun tanks were modified into tugs by the removal of their turrets. As towing vehicles they were effective but, because they lacked any form of winching equipment, they were unable to recover bogged tanks.

CENTURION ARV MARK 1

To fulfil this requirement, the Centurion ARV Mark 1 was produced as a stopgap measure to meet an urgent operational requirement for a more powerful recovery vehicle in Korea. Based on Centurion Mark 1 and 2 hulls, the turrets were replaced by a slab-sided superstructure housing a 72bhp Bedford QL truck engine to drive the winch. The vehicle was fitted with a spade at the rear in order to anchor itself during winching operations. In March 1952 the first models were rushed to Korea, where they equipped the REME Heavy Aid Detachment of the 5th Royal Inniskilling Dragoon Guards. Approximately 180 Centurion ARV Mark 1 vehicles were built. They were withdrawn from service in 1959 but remained as training vehicles well into the 1960s.

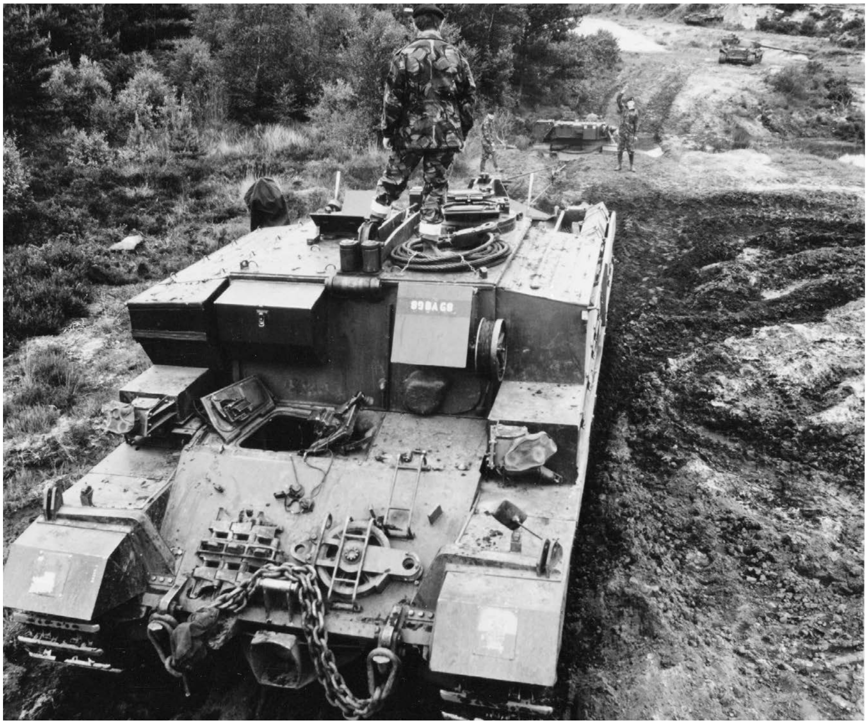
CENTURION ARV MARK 2

The design of a purpose-built Centurion ARV began at the Fighting Vehicles Proving Establishment in 1951. The first prototype was completed on New Year's Eve 1952. It underwent trials from February 1953 until July 1954. Production began in 1955 at Vickers-Armstrongs and ROF Woolwich Arsenal and the Centurion ARV Mark 2 entered service with the British Army in 1956. The basis of the ARV Mark 2 was a Centurion Mark 1, 2 or 3 hull with an armoured superstructure in place of the turret housing a winch powered by an auxiliary engine. The winch was capable of producing a direct pull of 30 tons or up to 90 tons using pulley blocks carried on the glacis plate. In



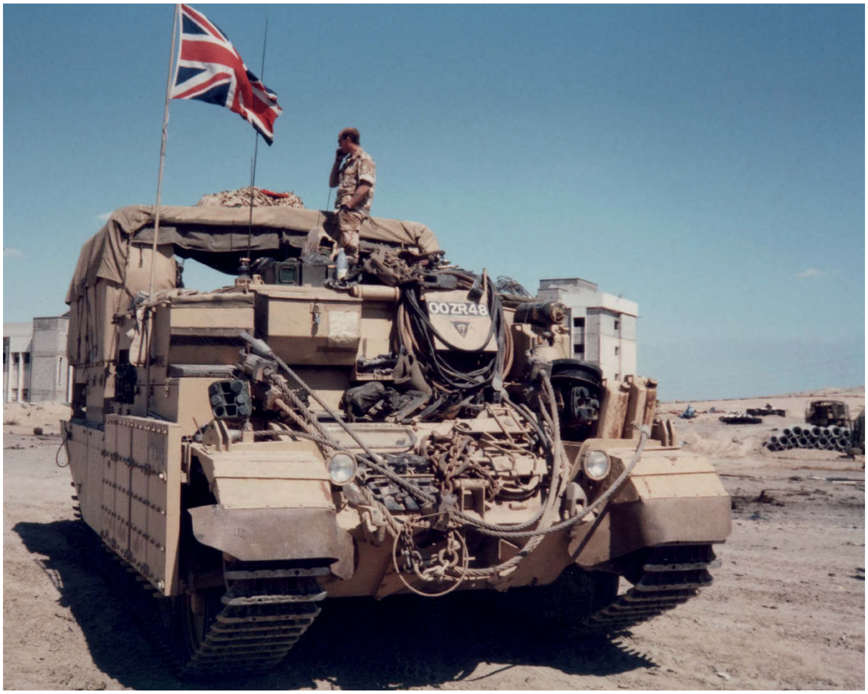
CENTURION ARV MARK 1, C SQUADRON, 1ST ROYAL TANK REGIMENT, COMMANDED BY SERGEANT T. GEORGE RNZAC, GLOSTER VALLEY, KOREA, 1953

The pressing need for a more powerful armoured recovery vehicle in Korea than the Churchill ARV Mark 2 prompted the production of a stopgap design pending the introduction of a purpose-built vehicle. Based on the hulls of redundant Centurions Mark 1 and 2, the ARV Mark 1 proved to be a capable machine. The ARV is painted overall and carries on the side stowage bin the C Squadron sign in red, outlined in white for greater clarity. Commanded by Sergeant George, on attachment from the Royal New Zealand Armoured Corps, the crew have advertised their trade with the slogan 'You Call – We Haul' on the gun planks stowed on the front superstructure. Markings include the insignia of 1st British Commonwealth Division on the right front trackguard, with the Royal Electrical and Mechanical Engineers (REME) flash and unit serial on the left. The first Centurion ARV Mark 1 00ZR05 was issued to 5RIDG on 28 January 1952.



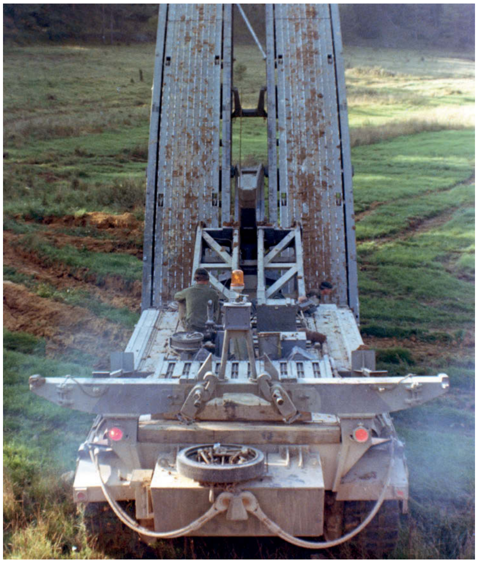
The Centurion ARV Mark 2 was a highly effective recovery vehicle and it served with the British Army from the Suez campaign of 1956 to the Gulf War of 1991.

During Operation *Granby* in 1991, the Centurion ARV Mark 2 was deployed in support of the Centurion AVREs of 26 and 31 Armoured Engineer Squadrons. Since most of the Centurions were almost 40 years old, they were known collectively as 'The Antiques Roadshow'.



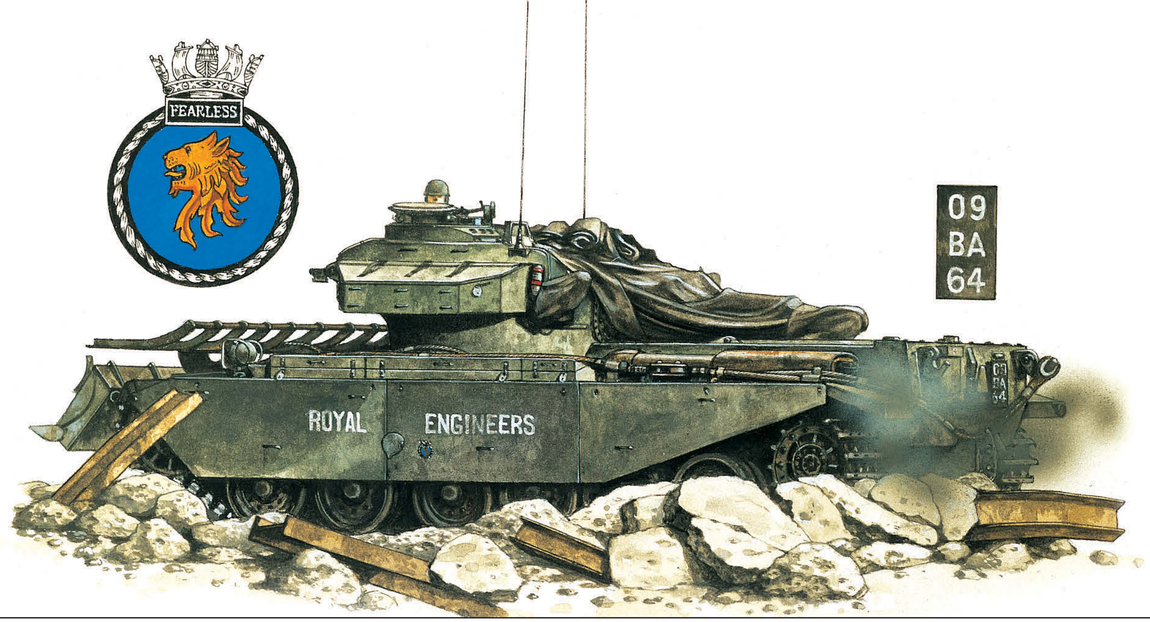
conjunction with the rear-mounted earth anchor, this allowed the ARV to recover even the most severely bogged tank. The ARV was able to recover lighter vehicles from the front and sides as well as push casualties by means of a wooden bumper bar at the front. The vehicle also carried numerous special tools and spares to undertake repairs in the field including oxyacetylene gas cylinders for welding and cutting. The vehicle armament was a single .30-calibre Browning machine gun mounted on the commander's cupola. With a crew of four, the vehicle was manned by REME personnel and four ARVs were attached to each armoured regiment of the Royal Armoured Corps with one for each tank squadron and one in regimental headquarters.

A Centurion Bridgelayer of 4 Canadian Mechanized Brigade Group deploys its No.6 Tank Bridge during an exercise in Germany. The bridge was capable of spanning gaps up to 45ft wide and of being recovered from each end.



CENTURION BRIDGELAYER AND ARK

Rivers, gaps and man-made anti-tank ditches are a major impediment to the advance of armoured formations. To negotiate such obstacles, the British Army introduced various specialized vehicles based on the Centurion hull. The Centurion Bridgelayer was based on a Mark 5 chassis and carried a No.6 Tank Bridge. Capable of launching in under two minutes, the bridge could span gaps up to 45ft wide and bear vehicles up to 80 tons in weight. With the addition of centre decking sections laid between the trackways, the complete range of armoured and 'soft skin' vehicles in a battle group could cross the No.6 Tank Bridge. For gaps of greater width up to 75ft, the Centurion ARK or Armoured Ramp Carrier was used with the vehicle itself entering the obstacle and acting as a central pier. The trackways could be either launched prior to entering or in the gap itself, depending on the nature of the banks. They could also be



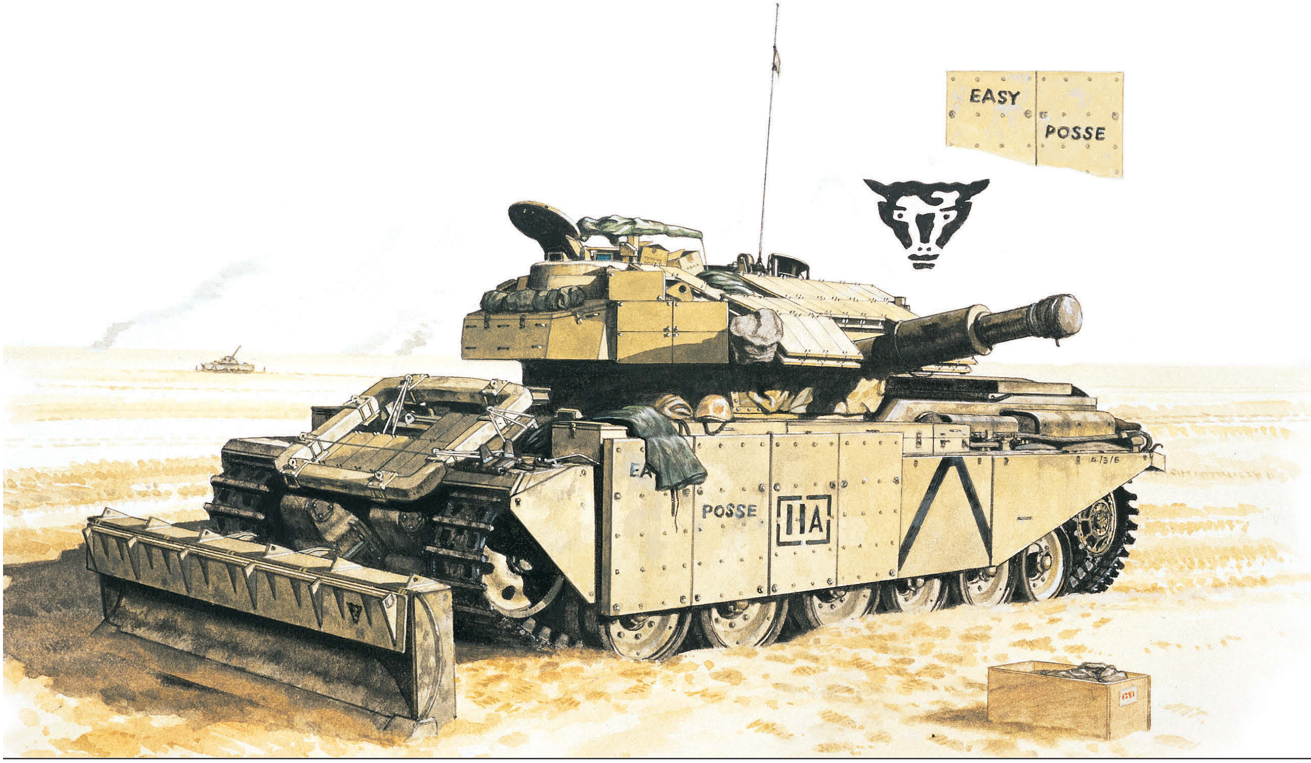
CENTURION MARK 5 AVRE, 26 ARMOURED ENGINEER REGIMENT, OPERATION MOTORMAN, CREGGAN ESTATE, LONDONDERRY, NORTHERN IRELAND, 31 JULY 1972

Operation Motorman was the largest operation conducted by the British Army since Suez in 1956. The object of the operation was to restore control in those areas of Ulster that were dominated by extremists of the nationalist movement, especially in the Creggan and Bogside estates of Londonderry and the Andersonstown and Ballymurphy areas of Belfast. At 0400hrs on 31 July 1972, four Centurion AVREs, their turrets traversed to the rear and their demolition guns shrouded beneath tarpaulins, entered the so-called No-Go area around the Rossville Flats and Creggan Estate in Londonderry. The AVREs were required to demolish the formidable barricades that had been erected to exclude the security forces. As it was believed that the barricades were booby-trapped with explosives, only an AVRE had sufficient armour protection against such a threat. In the event, the barricades were quickly dismantled without difficulty and the AVREs were soon withdrawn from the operation for fear of appearing provocative. The AVRE is finished in the standard British Army disruptive camouflage pattern of matt black stripes over a base colour of flat green. The vehicle registration number 09BA64 appears on the rear hull and in a single line at the top right of the glacis plate. There is little doubt as to the identity of the users of the Centurion AVRE as the bazooka plates testify. Below the Corps title is a decal of the ship's crest of HMS *Fearless*. The LPD HMS *Fearless* transported the AVREs to and from Ulster for Operation Motorman and the ship's crew zapped the vehicles before they landed in Londonderry.

deployed over walls and earthworks to provide a means of crossing for gun tanks and other vehicles up to a maximum weight of 80 tons. Launching of the trackways was by means of a single hydraulic cylinder driven by the main engine. Both types of Bridgelayer entered service with the British Army in 1963 and the Royal Engineers (RE) employed them.

CENTURION ARMOURED VEHICLE ROYAL ENGINEERS (AVRE)

As its name implies, the Centurion AVRE was also employed by the Royal Engineers. It was designed to undertake a number of roles on the battlefield in support of armoured formations. It mounted a 6.5in (165mm) low-velocity demolition gun to destroy field fortifications, pillboxes and other strongpoints on the battlefield. The AVRE could carry a fascine bundle on a front-mounted cradle. This was dropped into streams, trenches and anti-tank ditches to aid the advance where the launching of a tank bridge was inappropriate. In addition, a roll of metal Class 60 Trackway could be carried to provide a stable platform for vehicles to negotiate boggy ground such as a bridge approach or river crossing point. The AVRE could tow a special RE 7.5-ton four-wheel trailer designed to carry a fascine;



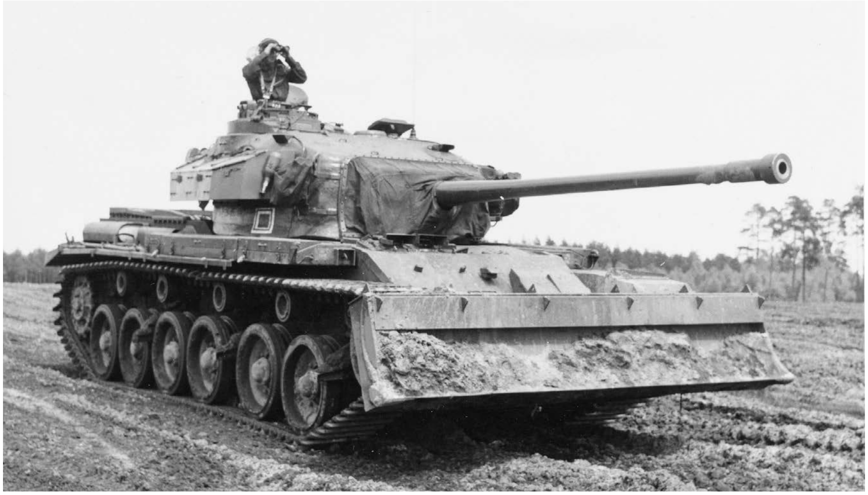
CENTURION MARK 5 AVRE, 32 ARMOURED ENGINEER REGIMENT, OPERATION DESERT SABRE, SOUTHERN IRAQ, FEBRUARY 1991

As part of Operation Granby, two Centurion variants, the AVRE and ARV, were dispatched to the Gulf with the Royal Engineers; 40 years to the month since the Centurion's first operational deployment in the Korean War. The Centurions were employed by the engineer squadrons of 21 and 23 Engineer Regiments and 32 Armoured Engineer Regiment. Each of the armoured brigades within 1st (BR) Armoured Division were supported by an engineer regiment – 23 Engineer Regiment with 4th Armoured Brigade and 21 Engineer Regiment with 7th Armoured Brigade. 32 Armoured Engineer Regiment remained a divisional asset as the Route Development Battle Group. The regiment included 31 and 77 Armoured Engineer Squadrons. Each squadron consisted of three troops, each equipped with two Centurion AVREs, two Chieftain Bridgelayers and two Combat Engineer Tractors. Their role was to assault and breach the Iraqi main defensive lines. In the event, the breach was quickly completed and armoured engineer assistance was not needed. During the actual hostilities, the regiment's principal task was to develop and protect a main supply route for wheeled logistic vehicles supporting the advance. EASY POSSE is the second AVRE in 1 Troop of 77 Armoured Engineer Squadron. The name EASY POSSE appears on the first two Chobham armour panels and the vehicle callsign on the third. The inverted 'Vee' is the mutual recognition sign of the coalition forces. On the rear bazooka plate is the vehicle zap code 4/3/B indicating the unit and its higher formation. At the top right on the hinged flap of the dozer blade and on the side of the fume extractor is the famous Bull's Head insignia of the World War II 79th Armoured Division that was adopted by 32 Armoured Engineer Regiment. For its intended use in the assault, the Centurion AVRE was extensively up-armoured with Chobham armour panels from the Warrior infantry fighting vehicle along the vehicle sides protecting the crew compartment and ERA blocks protecting the turret. On the glacis plate is an appliqué armour panel and a MIMIC – Magnetic Influence Mine Induction Coil. This device was intended to disrupt the fuses of magnetic mines before the vehicle passed over them.

Class 60 Trackway roll; demolition stores or other equipment. Other trailers included mechanical minelayers and the Giant Viper rocket-propelled mine-clearing equipment. The AVRE was fitted with a hydraulically operated dozer blade for clearance and denial; the creating or filling of anti-tank ditches; the preparation of river crossing places and bridge approaches; and digging gun emplacements and tank hull-down fire positions. The Centurion Mark 5 AVRE entered service in 1963 and it was used by the British Army during the Gulf War of 1991.

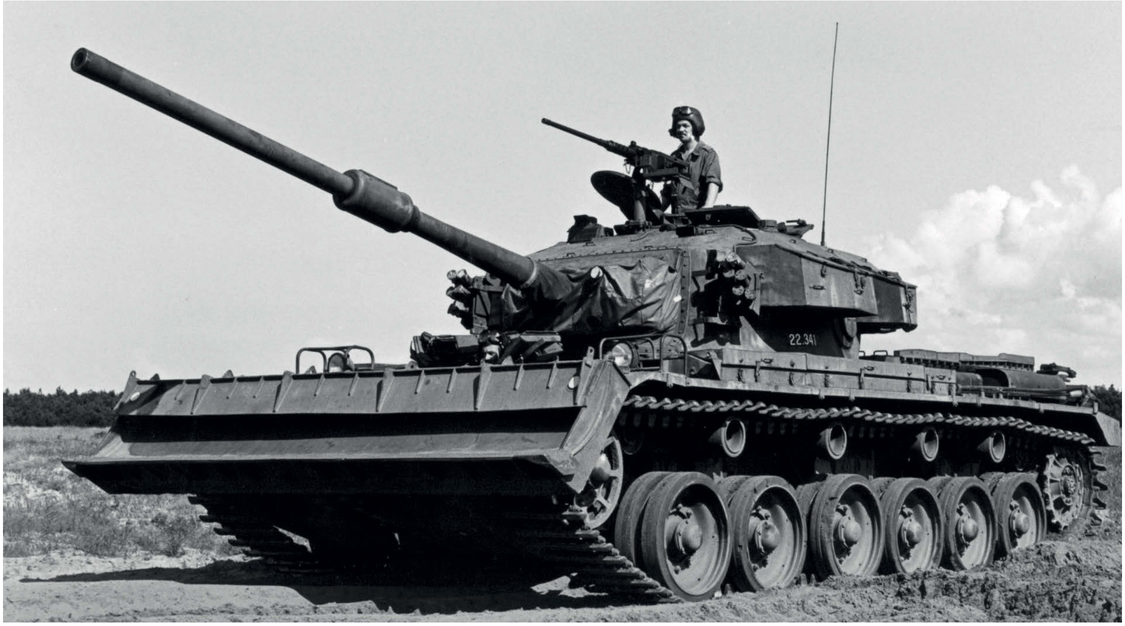
CENTURION MARK 5 DOZER

The Tank, Gun, Centurion Mark 5, Dozer was a standard Mark 5 gun tank fitted with a hydraulically operated dozer blade identical to that of the Centurion AVRE. Manufactured by Pearson's of Newcastle, the dozer blade incorporated a renewable steel cutting edge at the bottom and a hinged flap at the top. As the dozer blade filled with earth, the hinged flap rose into the driver's view giving an indication of blade load. A joystick in the driver's compartment controlled the dozer blade and the system had a comparable earth-moving capacity to the D6 Caterpillar bulldozer. As an indication of its performance, the Centurion Dozer was able to dig a hull-down firing position in light soil in seven minutes. Because of the extra weight of the blade, the Centurion Dozer was not up-armoured on the glacis plate. It entered service with the Royal Armoured Corps in 1961 and was usually issued on a scale of one per tank squadron.

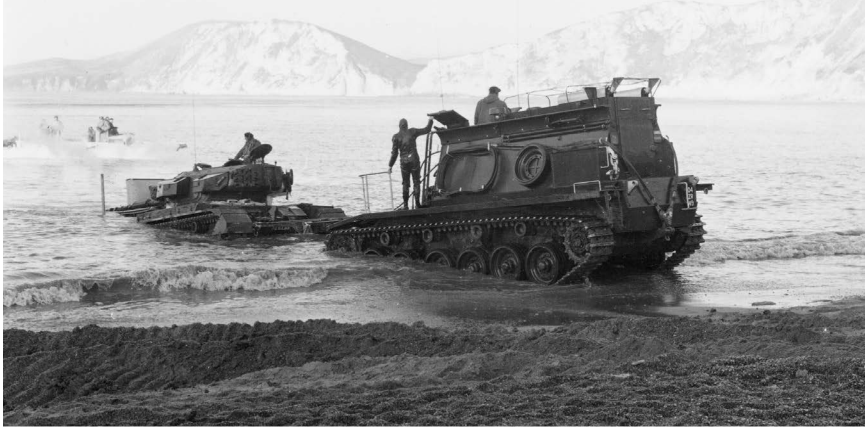


LEFT The Centurion Mark 5 Dozer provided a useful earth-moving capability within armoured formations with one issued per tank squadron. Tankdozers were exported to several foreign users of Centurions including Australia, which used them extensively during the Vietnam War.

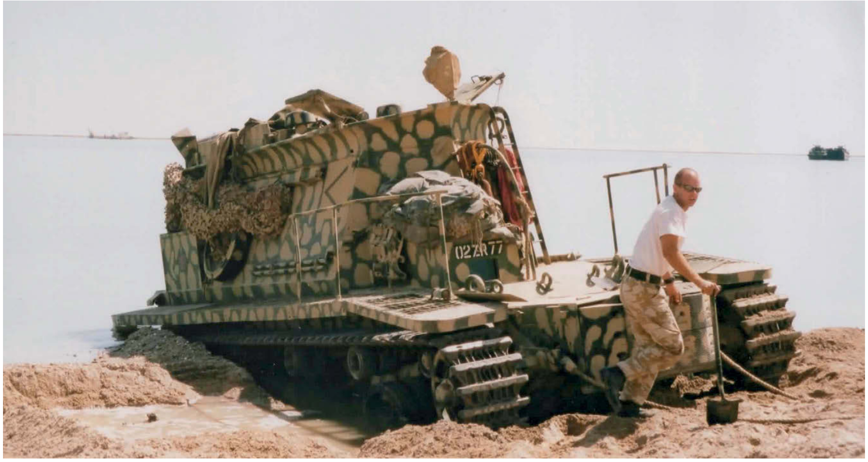
BELOW The Centurion Mark 5 Tankdozer was commonly attached to each armoured squadron to provide a ready means to create earthworks, tank scrapes and clear battlefield obstacles. This particular tankdozer belongs to the Danish Army: one of several NATO nations to be equipped with Centurion during the 1950s and 1960s.



TOP A Centurion Beach Armoured Recovery Vehicle fulfils its primary role of retrieving a stranded Centurion gun tank fitted with deep wading equipment during an amphibious landing exercise. The BARV was the last Centurion variant to see service with the British Army.



RIGHT 02ZR77 was the very last Centurion variant to see operational service with the British Army during Operation Telic in 2003. At the end of the deployment it was decided to take the BARV out into the desert for use as a hard target. Fortunately, wiser council prevailed and it was returned to the UK for posterity.



CENTURION BEACH ARMOURED RECOVERY VEHICLE (BARV)

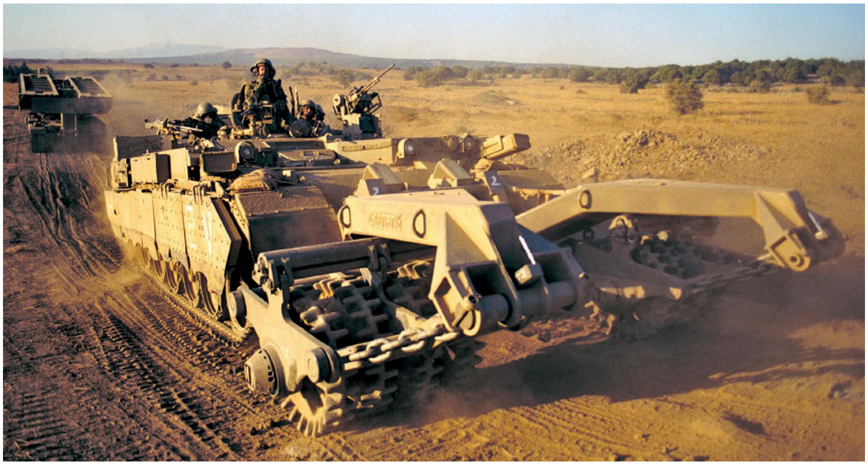
The primary role of the Beach Armoured Recovery Vehicle or BARV is to recover stranded tanks and landing craft during an amphibious assault. It is also used for many other general tasks during a beach landing such as laying Class 60 Trackway. The Centurion BARV was the last Centurion variant to see service with the British Army. Introduced in 1963, it was superseded in 2003 after a remarkable career of 40 years by the Hippo BARV, based on a Leopard chassis. The design and development of the Centurion BARV began in 1957 at the REME Fording Trials establishment at Instow in north Devon. Final development was undertaken at the Fighting Vehicles Research and Development Establishment (formerly FVPE) at Chertsey. The production of 12 Centurion BARVs was undertaken by the Royal Ordnance Factory Barnbow in Leeds and completed in 1963. The vehicle was able to wade to a maximum depth of 9½ft with a usual operating depth of up to 8ft. The BARV had a crew of four including driver, commander and two REME mechanics, one of whom was a qualified diver to attach towing cables to stranded vehicles under water. The Centurion BARV has seen extensive service with the British Army and Royal Marines, from the Middle East, with the Amphibious Warfare Squadron, to the Arctic, with the ACE Mobile Force Land in Norway. The two LPDs (Landing Platform Dock), HMS *Fearless* and HMS *Intrepid*, carried one Centurion BARV each and they were deployed operationally during the Falklands War of 1982 and both Gulf Wars.

SUMMARY

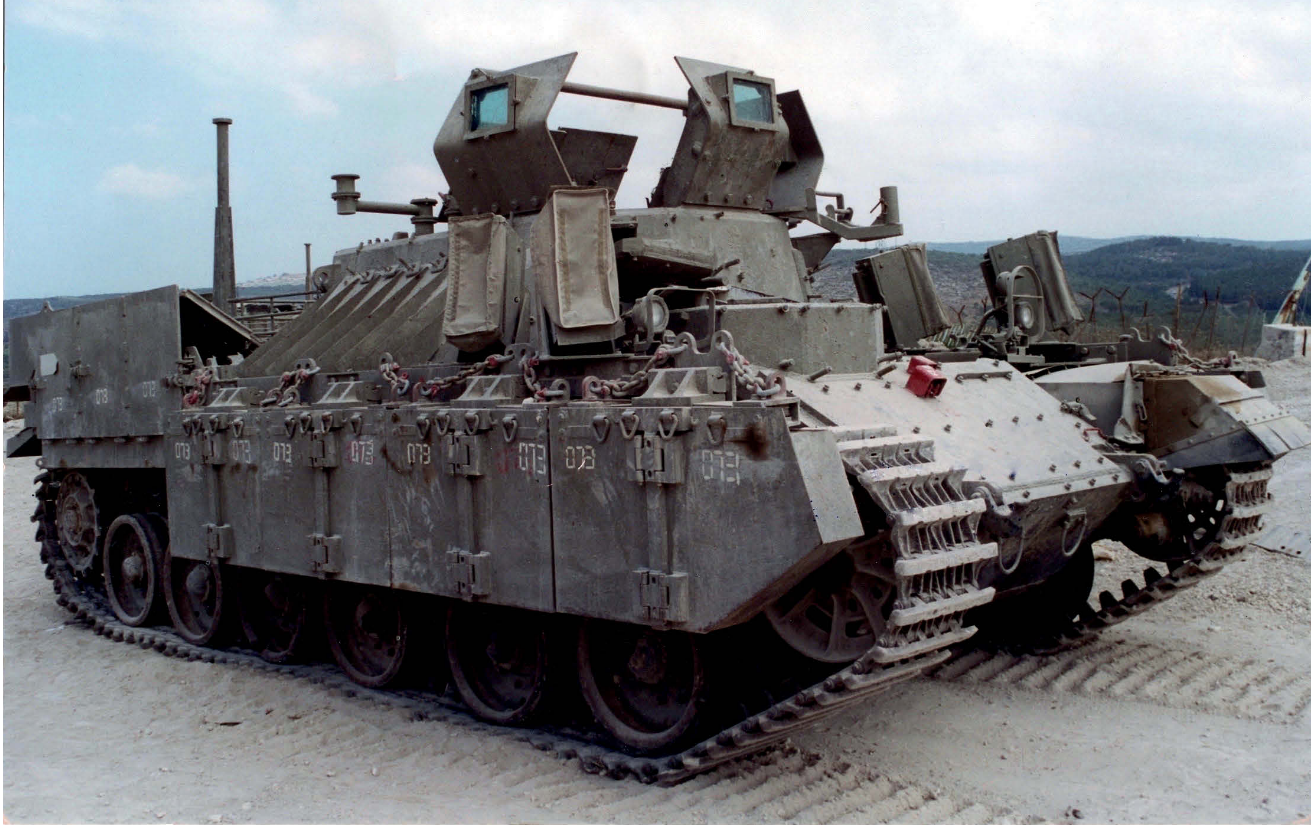
Despite the fears of the General Staff during World War II, the Centurion proved to be highly adaptable to a host of different roles. Those shown above were the principal variants to see service but there were many more experimental models based on the Centurion chassis. During the early 1950s, two long-range tank destroyers, the FV4004 and FV4005, were designed to counter the threat of the Soviet JSIII. The FV4004 Conway mounted a 120mm gun in a tall slab-sided turret and one prototype was built. The FV4005 carried an even heavier 183mm gun on a limited traverse mounting with an automatic loader as the Self-Propelled Heavy Anti-Tank Gun No 1. Again only one prototype was built and the Conqueror heavy tank subsequently fulfilled the role. A range of self-propelled artillery vehicles based on the Centurion chassis was proposed but only the FV3802 and FV3805 mounting a 25-pdr gun and 5.5in howitzer respectively appeared as prototypes. During the 1950s and early 1960s, many experiments were conducted to equip Centurion gun tanks with wading and flotation kits to allow them to reach the shoreline after disembarking from tank landing ships during amphibious assaults. Several of the wading kits were accepted for service and were used operationally in the Middle East and during the landings at Suez in November 1956.

CENTURION UPGRADES

After its successful combat debut during the Korean War, the Centurion next saw action with the British Army at Suez during the abortive campaign to regain control of the Suez Canal following its nationalization by Egypt in 1956. In both 1965 and 1971 the Centurions of the Indian army proved their worth in the costly and indecisive battles for the disputed territories of Jammu and Kashmir. In 1968 the Australian army increased its commitment to the Vietnam War with the deployment of Centurion tanks of the 1st Armoured Regiment. Despite the appalling terrain, the tanks proved to be a valuable addition to the offensive strength of the 1st Australian Task Force over the next three years before their withdrawal in 1972. In the Middle East, the Centurions of the Royal Jordanian army fought a bitter battle in September 1970 when the 40th Armoured Brigade destroyed numerous T-54/55 tanks during a Syrian invasion in support of the Palestine Liberation Organization.



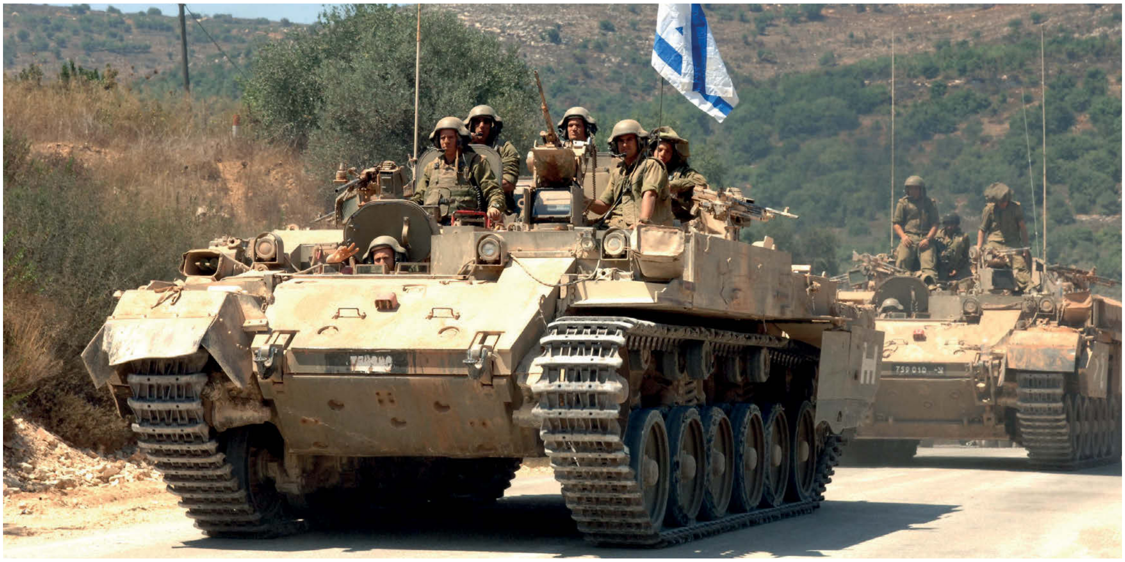
A PUMA equipped with NOCHRI RKM mine rollers leads an M60 AVLB bridge layer during an exercise on the Golan Heights. NOCHRI meaning 'Foreigner' is based on the Soviet KMT-5M type of which many were captured during the October War of 1973.

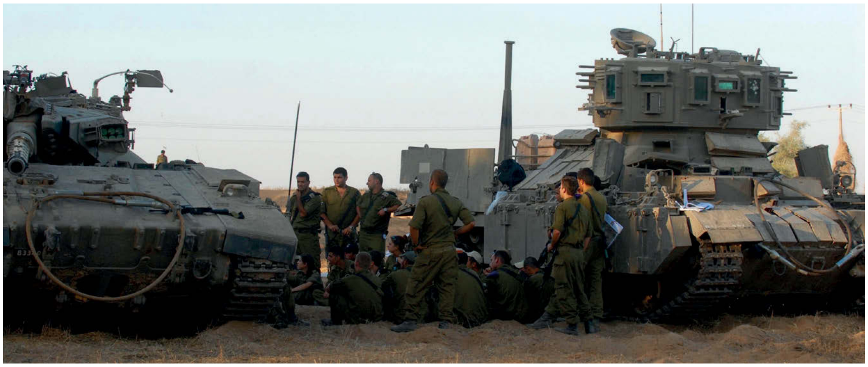


Once the Shot Cal gun tank was withdrawn from frontline service many of the redundant hulls were converted to the role of heavy APCs given the light armour of the standard M113. This particular version is the NAGMACHON with attachment points for Blazer ERA blocks and armoured shields with bulletproof glass for the crew members to man the multiple machine guns carried on the vehicle.

Although the Centurions of the Israeli Armoured Corps proved highly successful during the Six Day War of 1967, the IDF had recognized several limitations of the tank. In particular, the ageing Meteor petrol engines and the inadequate combat range for desert warfare were significant problems that had to be rectified. The first priority was to find a suitable replacement engine. The operational requirement demanded that it had to be readily available on the world market; be of reasonable cost; provide the specified performance; be suitable for local conversion, and fulfil the ease of maintenance needs. All three engines that were tested proved satisfactory but they did require a modified rear hull to accommodate the larger powerpack. Finally, the Teledyne Continental AVDS-1790-2A air-cooled diesel engine was selected, as it was also suitable for the M48A2 Pattons that were being upgraded at the same time. The powerpack incorporated an Allison CD-850-6 automatic transmission that greatly eased the task of driving over long distances and simplified driver training. Together with many other detail changes, the new powerpack provided greater range; a higher top speed; and, being diesel, reduced the fire risk, which increased 'crew survivability'. This factor was of great significance to the Israelis as many tank crews suffered grievous wounds from burns when petrol-engined tanks caught fire after being hit in combat.

In all, the comprehensive improvement programme for the Centurion took some three years. To mark its entry into service in May 1970, the Israeli Ordnance Corps re-designated the vehicle as the Upgraded Centurion, but tank crews called it the Shot – Hebrew for 'whip'. By now, all the Centurions within the Israeli Armoured Corps had been fitted with the L7 105mm gun with improved ammunition stowage and an increased load of 72 rounds. All these factors were to be crucial during the opening days of the Yom Kippur War, which erupted on 6 October 1973 with simultaneous invasions by the Egyptian and Syrian armies. On the northern front defending the Golan





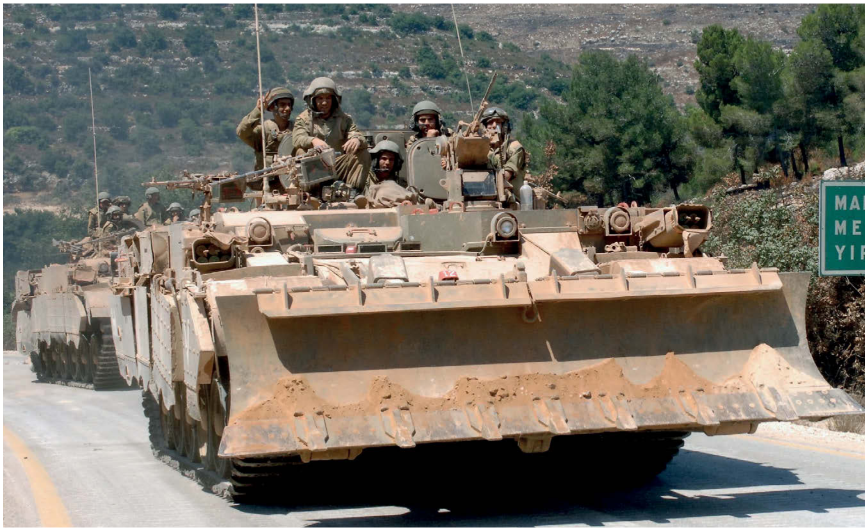
ABOVE The most widespread conversion of the Shot Cal chassis was the PUMA that derived from Poretz Makshim Handasati or 'Breakthrough Mine Engineer Vehicle'. As its name implies, it is employed by the armoured engineers for a multitude of tasks on the battlefield. These PUMAs are returning to Israel after Operation Change of Direction in Lebanon during 2006.

LEFT A later version of NAGMACHON featured a fully enclosed armoured superstructure known as the 'Doghouse' for greater protection of the crew. It incorporates multiple armoured glass vision ports and firing slits for personal weapons and machine guns as necessary. These AFVs are taking part in Operation Summer Rains in the Gaza Strip during July 2006.

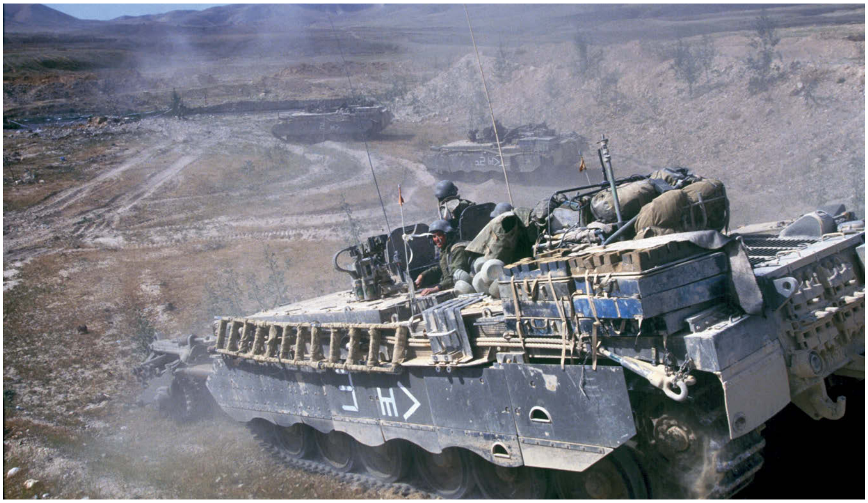
Heights, the Israelis deployed 177 Upgraded Centurions manned by the elite 7th Armoured and 188th Barak Brigades. Both these regular formations fought a critical battle to stem the armoured onslaught of some 1,200 Syrian tanks, including hundreds of the formidable T-62 with its powerful 125mm main armament. For 48 hours, the ever-decreasing number of Shots fought the Syrians to a standstill as the Israelis desperately dispatched reservists and their tanks to the defence of the Golan Heights as soon as they were mobilized. After 51 hours of almost continuous battle, the Syrians began to withdraw leaving 500 knocked-out tanks and a similar number of other AFVs on the battlefield'. It is no exaggeration to say that the 177 Centurions of the 7th and 188th Brigades saved the state of Israel from catastrophe.

After the Yom Kippur War, with the frightening number of casualties among Israeli tank crews, the development of the indigenously designed Merkava main battle tank (MBT) was accelerated with the main emphasis on 'crew survivability'. Many of the casualties were caused by the widespread use of wire-guided anti-tank missiles and rocket-propelled grenades (RPG). Urgent measures were taken to develop greater protection against the specific threat of high-explosive anti-tank (HEAT) warheads. In the late 1970s, the Upgraded Centurions and M60-based Magach MBTs were fitted with revolutionary supplementary armour known as Blazer. Consisting of a series of individual explosive blocks, explosive reactive armour or ERA disrupts the armour-

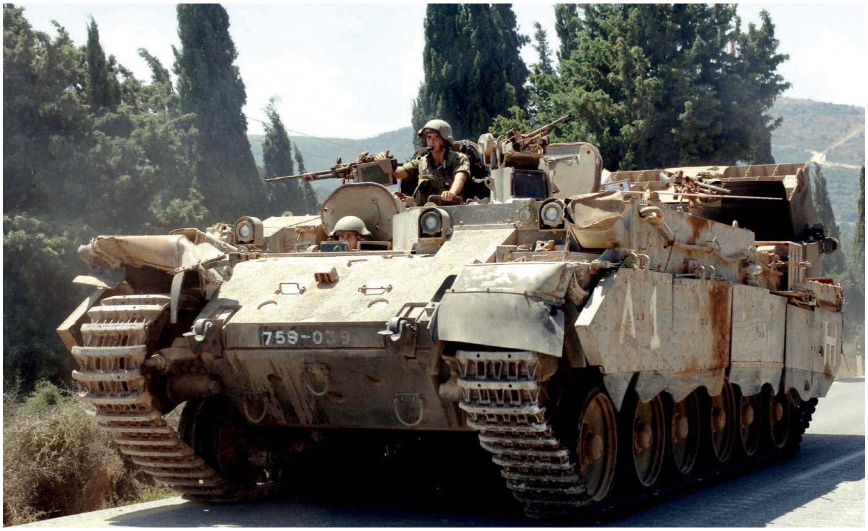
TOP The PUMA is able to mount a variety of engineering equipment depending on the task in hand by means of a universal adaptor plate mounted on the front hull, including mine rollers, mine plough or a bulldozer blade as here on a PUMA returning from operations in Lebanon in 2006.

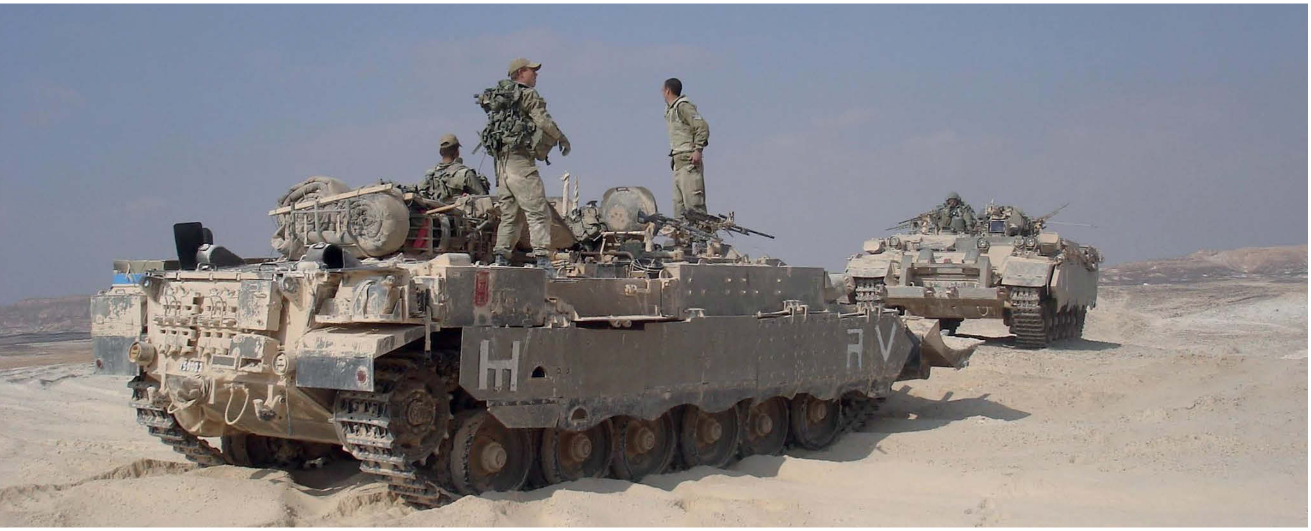


BELOW RIGHT A PUMA with NOCHRI minerollers takes part in an exercise with the markings indicating third platoon of second company with the insignia of the Combat Engineering Corps just in front of the white chevron. On the rear hull trackguards are mine walker pads to allow combat engineers to negotiate anti-personnel minefields.



The PUMA is heavily armoured with appliqué compound armour panels along the sides and on the glacis plate as well as supplementary armour on the belly to mitigate against mines and IEDs. At the rear, this PUMA mounts a Rafael CARPET rocket propelled Fuel Air Explosive Mine Breaching System to clear a path 100 metres long by ten metres wide within one minute of activating.

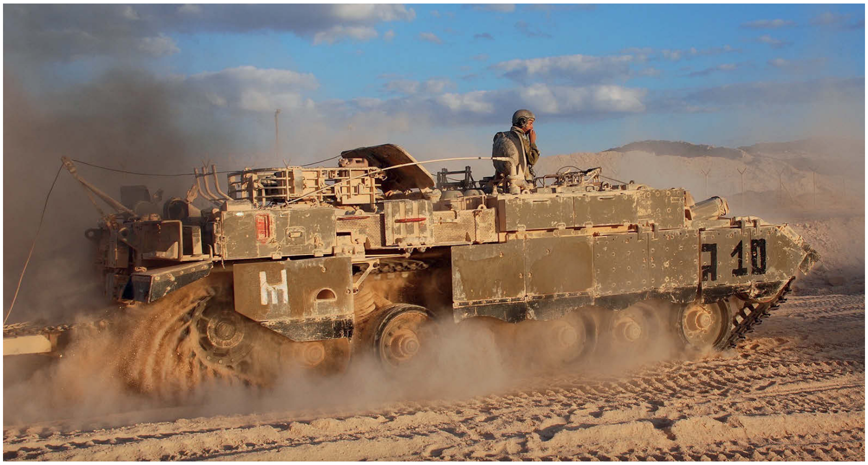




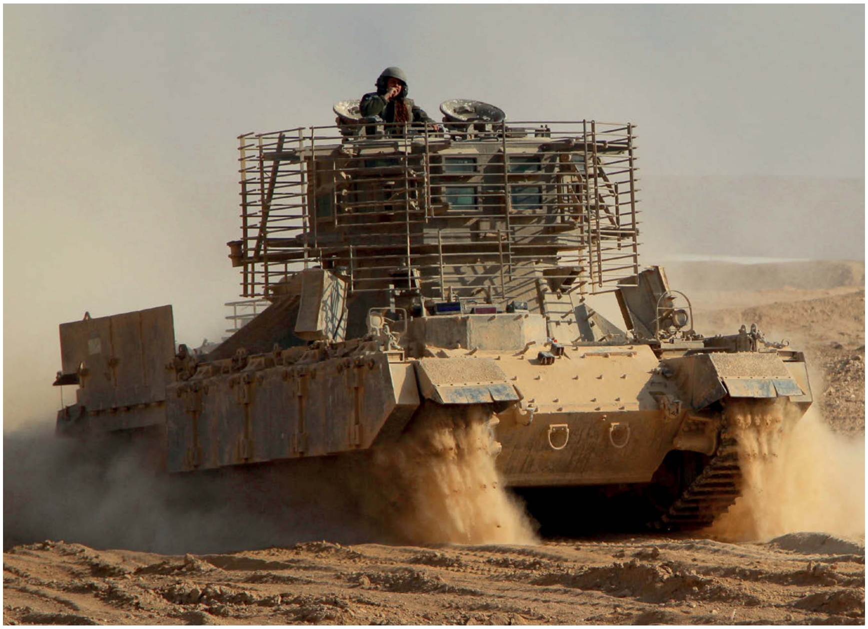
As a combat engineer assault vehicle, the PUMA is at the forefront of any offensive action and is accordingly fitted with several machine guns as well as a remotely fired Rafael Overhead Weapon System or OWS and a 60mm mortar. It has a crew of three men plus five other combat engineers.

piercing properties of HEAT weapons and prevents penetration of the tank's main armour shell. Tanks fitted with ERA were first used operationally during the Israeli incursion into Lebanon in 1982 where it proved highly effective against attack by Sagger missiles and RPGs, even at point-blank range.

As the Merkava entered service in greater numbers, the Shot was progressively withdrawn from frontline duty. Some of the redundant gun tanks were then converted into heavy armoured personnel carriers (APCs) following the loss of numerous lightly armoured M113 APCs in the close-quarter fighting experienced in southern Lebanon. The original requirement was put forward by the IDF Engineering Corps to provide greater protection for combat engineers in their dangerous tasks. Designated as the Puma, the combat engineer APC first appeared in 1984. It was followed by further models based on an Upgraded Centurion chassis, including the Nagmashot, Nakpadon and Nagmachon. All these feature extensive armour arrays of both passive special armour of the Chobham variety and ERA. The vehicles are armed with a range of machine guns, mortars and an instantaneous smoke-screening system. Over 700 Centurion variants remain in service with the IDF and it is likely that they will do so for several years to come.



For greater versatility, the PUMA can tow trailers carrying specialised engineering equipment, as here, with a quick-release cable running to the commander's position. The original PUMAs were powered by the same 750bhp AVDS-1790-2A diesel engine as Shot Cal but later models like this one incorporated the 908bhp AVDS-1790-6A with upgraded CD-850-6 transmission and suspension system of Merkava Mark 1 and 2.

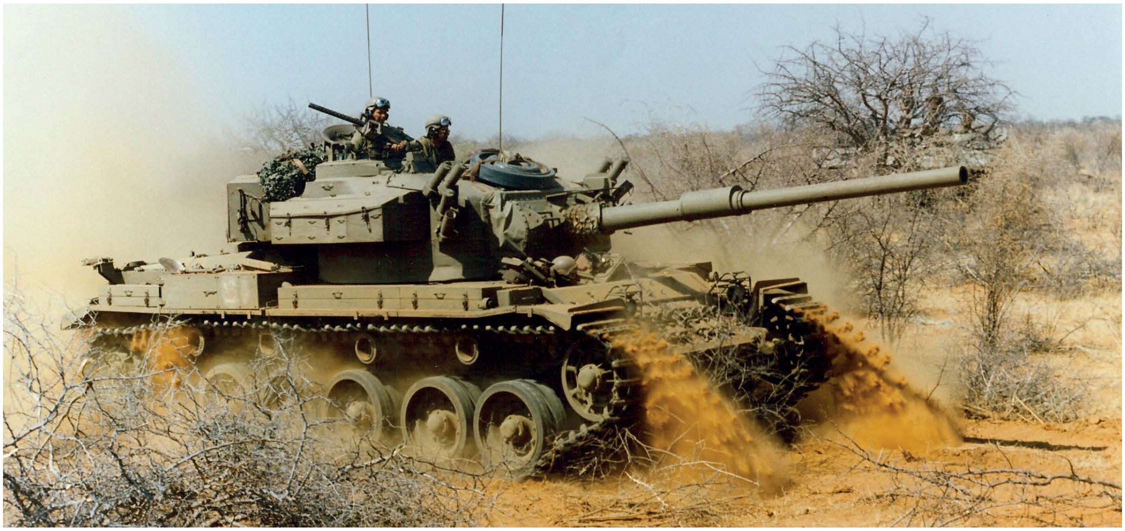


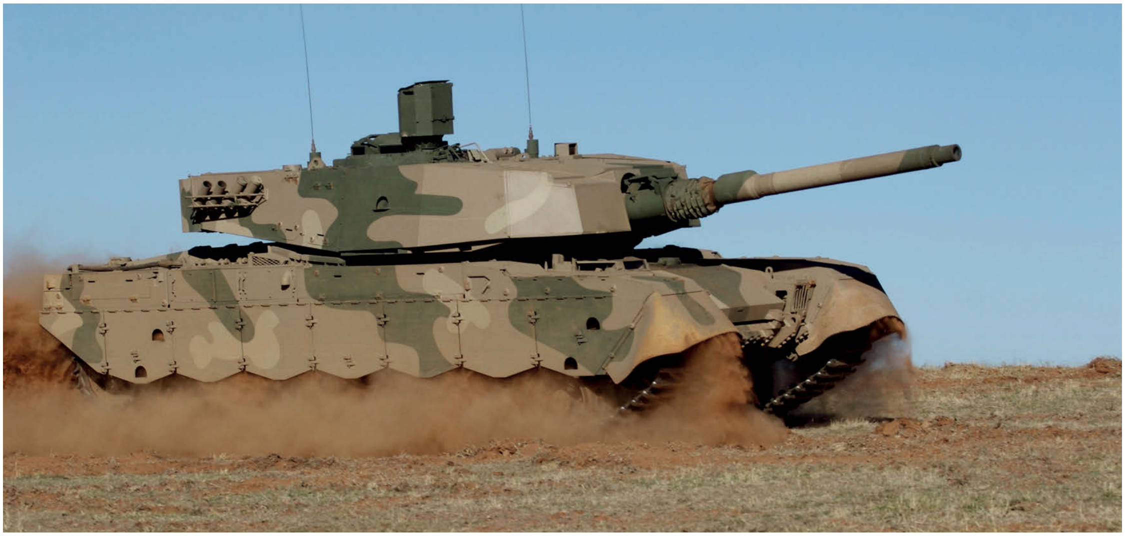
The final model of NAGMACHON featured 'bar armour' around the Doghouse to thwart RPG weapons. In this guise, the vehicle is known as 'The Monster' and is widely used as a command vehicle when operating with 'Doobi' armoured Caterpillar D9R Bulldozers during counter-terrorism operations in urban terrain.

THE OLIFANT

During the late 1960s and early 1970s, several of the armies in Europe equipped with Centurions devised upgrade programmes similar to that of the Israelis, with the obsolescent Meteor engines being replaced by a new diesel powerpack and improvements to the fire-control system. Although they all proved successful in engineering terms, none came to fruition and more modern main battle tanks such as the Leopard 1 superseded the Centurions. However, the Republic of South Africa, which was subject to an international arms embargo, had to draw on its own resources to procure modern weapons systems. The South African army acquired the first of 200 Centurion Mark 3s in 1952. These were then modified to become Mark 5s with

An Olifant Mark 1 of E Squadron motors at speed across the barren scrubland of Angola in the final days of the Bush War in Angola in 1988.





The Olifant Mark 2 is the final incarnation of Centurion as a gun tank. It features a 1,040bhp Teledyne Continental diesel engine as against the 650bhp Meteor petrol engine; advanced compound armour and a complete day/night thermal imaging fire control system for the 105mm gun firing the latest Israeli ammunition.

the substitution of the 7.92mm Besa coaxial machine gun by the .30-calibre Browning. In 1972 an improvement programme codenamed Skokiaan saw the replacement of the Meteor/Merritt-Brown combination with an 810hp fuel-injected petrol engine and a three-speed automatic transmission, but only eight conversions were undertaken. Together with another 27 Centurions, these eight were further modified with a new powerpack in 1974 to become the Centurion Mark 5A or the Semel.

By 1987, the tank had undergone a drastic revival in SADF service. Largely sidelined by the doctrinal shift in the late 1960s towards wheeled vehicles, half of the original South African Centurion fleet had been sold to Switzerland in 1965. But in the light of combat experience in Operation Savannah in 1975, the SADF had reversed its position and embarked on a modernization programme for its Centurion Mk 5s, still armed with their original 20-pdr guns, in 1976. Progressing from the earlier, interim Skokiaan (Moonshine) and Semel (Bran) projects, the resulting Olifant Mk 1 was a substantial rebuild and mechanical upgrade of the original Centurion by the Olifant Manufacturing Company of Benoni (in Johannesburg's East Rand) and by the army's 61 Base Workshop. It was re-engined with a 29-litre Continental turbodiesel (sourced from Israel) which produced some 750hp and 2,332Nm of torque. Maintenance was considerably simplified by rail-mounting the engine as an integrated powerpack, and overall its mobility was substantially improved over that of the base Centurion.

The Olifant Mark 1A followed in 1985 with a new diesel powerpack developing 750hp coupled to a semi-automatic transmission, and a mounting for a searchlight above the gun barrel. The Mark 1A was also upgunned, with the 84mm 20-pdr replaced by the 105mm L7. Locally manufactured as the GT-3B by Lyttleton Engineering Works (LEW), South Africa received substantial Israeli aid in its development, in addition to purchasing substantial stocks of L52 armour-piercing discarding sabot (APDS), M456 HEAT, and by 1987, M111 APFSDS tank rounds. The M456 could penetrate some 420mm of RHA at any range, whilst the first-generation long-rod tungsten-alloy penetrator of the M111 punched through some 390mm of RHA at the muzzle. Either could easily defeat the T-55 and T-62, especially at the very short ranges of bush warfare. Both of the 105mm anti-tank

ABOVE An Olifant Mark 1A lights up the sky during a night firing exercise on the de Brug training area near Bloemfontein.

RIGHT With its full thermal imaging day and night sights for both gunner and commander, the Olifant 2 has outstanding night fighting capability with no comparable opposition in sub-equatorial Africa. Accordingly only 26 Olifants were upgraded to the Mark 2 standard and the majority are kept in storage to meet any future conventional threat to the Republic of South Africa.

rounds were found to be far more lethal in that role than the 90mm of the Ratel and Eland, thanks to their far superior behind-armour effects. Fire control was greatly improved, with the original 6x stadia sight replaced with an Eloptro 8x gunner's day sight co-mounted with a laser rangefinder. Data from the rangefinder was automatically fed into the Olifant's split range drum, which then automatically applied elevation to the gun. Taking a myriad of other ballistics data into account, the system could produce exceptional accuracy and APFSDS groupings of 50cm x 50cm at 2,000m were achievable. Capable of achieving first-round hits at

2,000m-plus, the system was somewhat overkill at the short ranges of the Angolan bush but would have been an enormous asset if fighting ever crossed into the open expanses of northern Namibia.

The Olifant retained the original armour of the Centurion (152mm RHA on the mantlet and 76mm inclined at 60 degrees for the glacis), and was protected all round against the dreaded 23mm anti-aircraft gun that had so plagued the Ratel crews. The SADF freely admitted that the Olifant was vulnerable to the T-55's 100mm gun, to say nothing of the T-62's APFSDS-firing 115mm, as well as RPG-7s and nearly any Soviet ATGM system. Work continued on the development of improved Olifant variants and a next-generation tank to counter a feared deployment of T-72s to Angola. This threat never materialized and the Olifant primarily went into battle against standard FAPLA T-55s.

Further development continued and the definitive model, the Mark 1B, appeared in 1991. In fact, the Olifant Mark 1B was a comprehensive rebuild from the ground up with a completely new suspension system of torsion bars housed inside a revised double floor hull. Yet another new powerpack was fitted to the Mark 1B, a V-12 diesel engine of 950hp coupled to a new AMTRA automatic transmission with four forward and two reverse gears. The Mark 1B has a higher top speed and much improved reliability as compared to earlier models and the new suspension provides superior cross-country ability and crew comfort.

The firepower of the Olifant Mark 1B is much enhanced by a computerized fire control system with an integral laser rangefinder in the gunner's day/night sight. The commander has a similar sight and the remainder of the crew have improved vision devices at each of their stations. The L7 105mm gun is fitted with a thermal sleeve to increase accuracy of the main armament at long ranges. A total of 68 105mm rounds can be stowed inside the tank and it is further armed with two 7.62mm machine guns as well as eight 81mm smoke grenade launchers. While the mobility and firepower of the Mark 1B have been much improved, protection has also been considerably increased with the addition of special passive armour panels on the glacis plate and turret including the roof. The turret incorporates new enlarged stowage bins at the rear; tank crews soon discovered that the largest one could be used as a bath. This has been proved to be beneficial for hygiene in the hot climate and the stowage bin now incorporates a specially designed drain plug for this purpose. The bazooka plates have also been redesigned to allow easier access to the suspension and reduce dust clouds being thrown up by the tracks during operations in the bush. With all these improvements, the Olifant Mark 1B weighs 58 tons with a maximum speed of 36mph; a great improvement over the 21mph of the original Centurion.

Fifty years after they were manufactured, the South African Centurions in their new guise as Olifants are the most powerful MBT in sub-Saharan Africa. The South African army retains a fleet of 224 Olifant gun tanks, as well as a number of special-purpose variants. A new turret designated Olifant 2 has been developed that features a state-of-the-art hunter/killer-type fire-control system comparable in performance to the M1A2 Abrams. The Olifant 2 can also mount an LIW 105mm GT-8 rifled gun or a 120mm smoothbore gun as main armament. This turret can be placed in production quickly should the need arise and be fitted to existing Olifant hulls to create a formidable and cost-effective MBT for the 21st century. Few weapon systems have had such longevity in frontline service as the Centurion. It is a remarkable tribute to the British designers that a tank conceived in 1943 should still be in frontline service in the 21st century.

CENTURION IN COMBAT

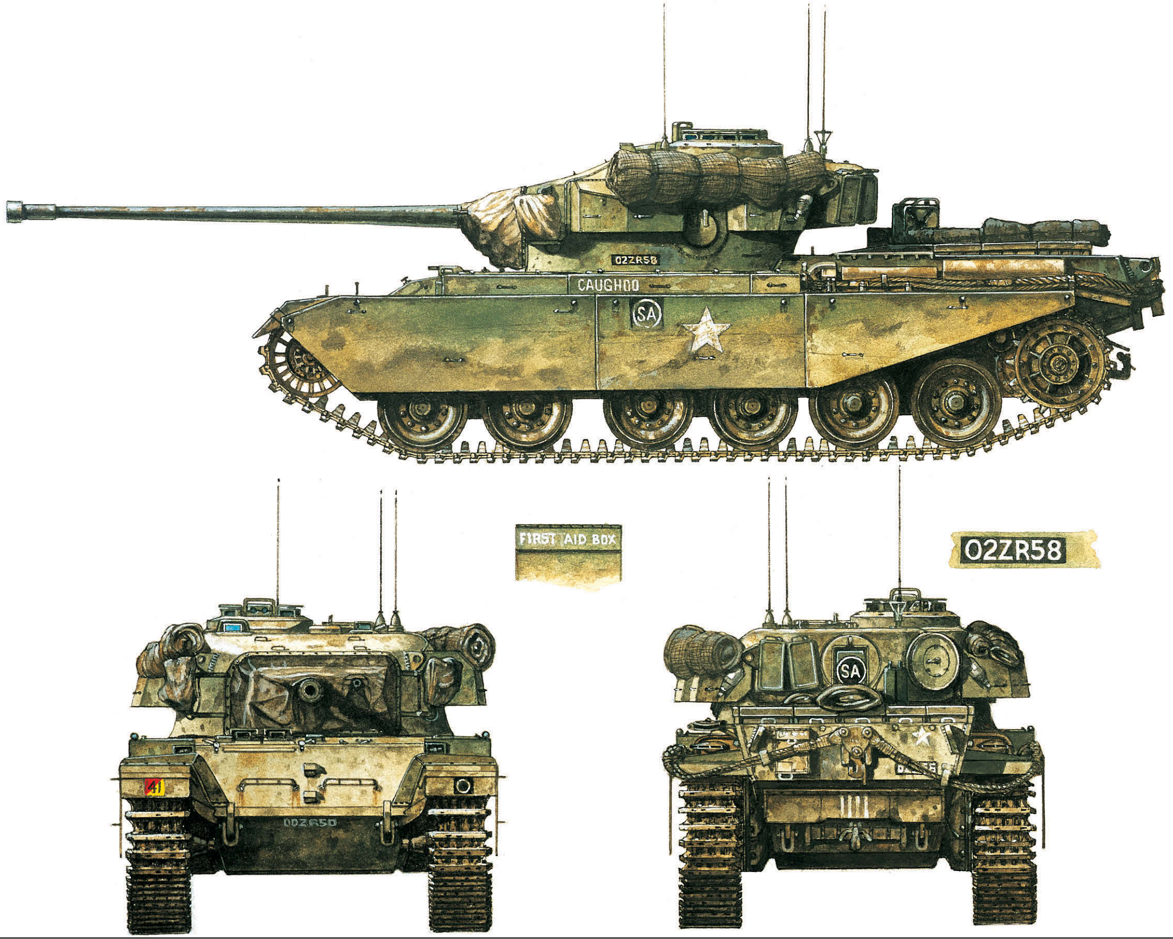
KOREA

The grand alliance between the western powers and the Soviet Union soon dissipated into acrimony after the victory parades of 1945 that marked the defeat of Nazi Germany and its Axis partners. When Josef Stalin imposed communist governments in those eastern European countries occupied by the Red Army, the West created the Federal Republic of Germany in June 1948, whereupon the Russians imposed a blockade on the city of Berlin that was divided between the four erstwhile allied powers – France, Great Britain, the Soviet Union and the United States. The Cold War was now a reality with the opposing forces deployed along the Inner German Border at a time of increasing tension. The Berlin Blockade lasted for 318 days before Stalin abandoned the siege on 12 May 1949, but tension remained high. During the previous month, a military alliance of 12 western powers was created as the North Atlantic Treaty Organisation or NATO. In response, the Soviet Union subsequently formed the Warsaw Pact incorporating all the occupied countries of eastern Europe. The stage was set for many years of confrontation and hostility. And the first encounter came in the far peninsula of Korea.

Under the auspices of the United Nations, a multi-national army was assembled following the invasion in June 1950 of the Republic of Korea by the North Korean People's Army at the instigation of Josef Stalin. The British committed the 27th Infantry Brigade to South Korea from their station in Hong Kong, soon followed by 29 Independant Infantry Brigade Group. The latter was supported by the 8th Kings Royal Irish Hussars and together they trained north from the port of Pusan to the North Korean capital of Pyongyang, where they unloaded just as the Chinese People's Volunteer Army entered the war. There ensued what was known as the 'Great Bug Out' when UN forces fell back in disarray. The two British brigades retreated as well but at no time were the tanks in contact with the enemy. In sub-zero temperatures and on frozen unmetalled roads, the brand-new Centurion tanks, some with just 28 miles on the clock, were pushed to the limits as they withdrew some 200 miles to Suwon where they spent Christmas. Despite the appalling conditions, the Centurions performed admirably without breakdowns, although one had to be abandoned to the enemy when it shed its tracks and there were no recovery vehicles to tow it to safety.

During the bitter winter of 1950/51, with temperatures down to minus 45 degrees Fahrenheit, the British awaited the inevitable Chinese offensive: as one subaltern observed on 9 January 1951: 'This has been one of the bloodiest days I can remember… we have given up thinking about the Chinese… all we could do is throw snowballs at them… did a 2½-hour stag at 4am in a state of numbness and semi-consciousness.' Five days before, the battle of Happy Valley

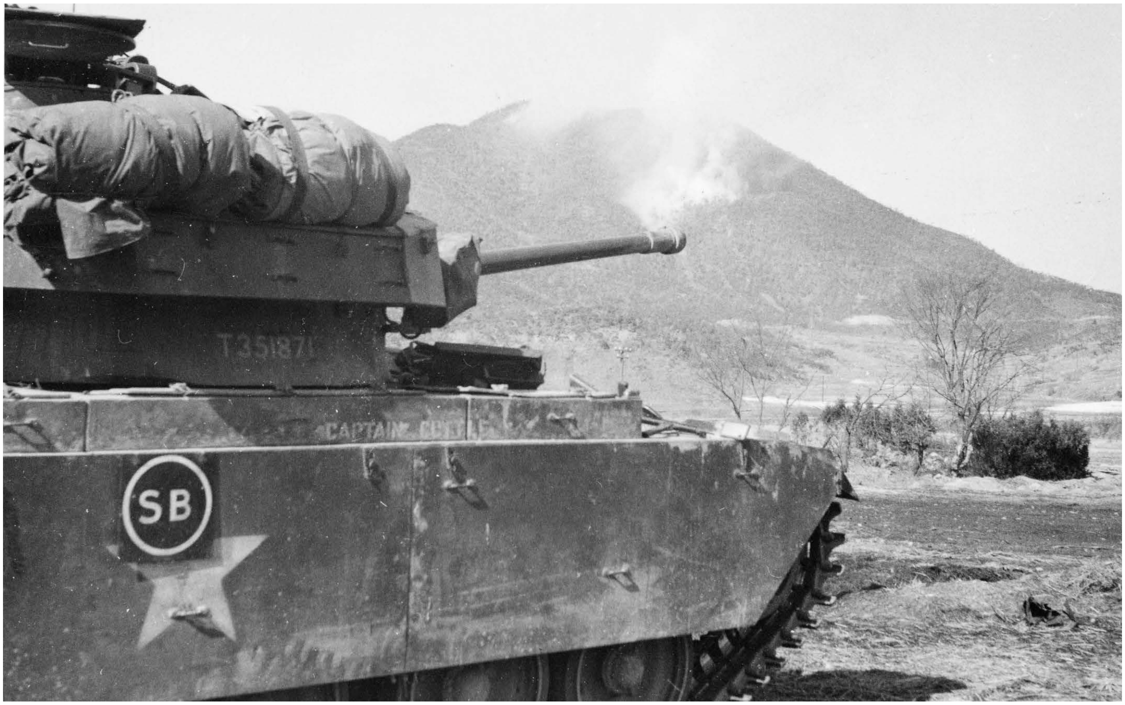
A Centurion Mark 3 of the 8th King's Royal Irish Hussars transports infantry of the Royal Australian Regiment across a pontoon bridge over the Imjin River in April 1951. The Centurions of the 8th Hussars proved to be a critical factor in the battle of the Imjin River when the Chinese Spring Offensive was halted by the massive firepower of the United Nations forces.



CENTURION MARK 3, C SQUADRON, 8TH KING'S ROYAL IRISH HUSSARS, COMMANDED BY CAPTAIN GEORGE STRACHAN MC, YONGDUNGPO, KOREA, 11 FEBRUARY 1951

The first Centurion to fire a shot in anger was CAUGHOO, an early production Centurion Mark 3 belonging to C Squadron HQ Troop, 8 KRIH and commanded by Captain George Strachan MC. As befitted a famous cavalry regiment, the names of 8th Hussars tanks in Korea were equestrian in nature. A (traditionally known in the KRIH as R) B and C Squadrons named theirs after hunts, hunters and hounds; e.g. ALYCIDON, ALY SLOPER, APRIL FOOL, BERKELEY, BOSUN, BOXER, COLORADO, CAMERONIAN and COLONIST. The names of Regimental HQ vehicles began with the letter H, e.g. HUMORIST, HALCYON and HURRY ON – the traditional name of the regimental commander's tank. During the initial mobile phase of the Korean War, all Allied vehicles displayed prominent white stars – the recognition sign of the United Nations Forces. In 1948 a civilian-type plate bearing numerals and letters superseded the wartime 'T' number registration system for tanks. The registration number of CAUGHOO is 02ZR58, carried on the rear hull plate, and on a black strip on the turret sides and lower front hull. The vehicle callsign, SA within a circle, denotes the second tank of C Squadron HQ Troop. It is displayed on a black metal plate on the centre bazooka plate and turret rear. The loose metal plates were often lost in action and CAUGHOO lacked one on the other side. On the left front track guard (as viewed) is the RAC flash with the unit serial '41' superimposed in black, while on the right is the 'frozen orifice' formation sign of 29 Independant Infantry Brigade Group, a white ring on a black square. The tank is liberally stowed with tarpaulins, bed rolls and crew comforts to ward off the bitter cold of the Korean winter, as well as water jerrycans, rimless RAC helmets and discarded ammunition boxes as extra stowage bins. The generous allocation of American stores made these essential items. On the cooling air deflector beneath the rear hull plate is the black and white convoy distance marker, common to all Centurions.

had seen the Cromwell tanks of the Recce Troop, 8th Hussars, and the Cromwell Artillery Observation Posts (AOPs) of 45 Field Regiment RA, fighting in support of the Royal Ulster Rifles while C Squadron, 7 RTR, supported the Royal Northumberland Fusiliers. Casualties in men and machines were high.

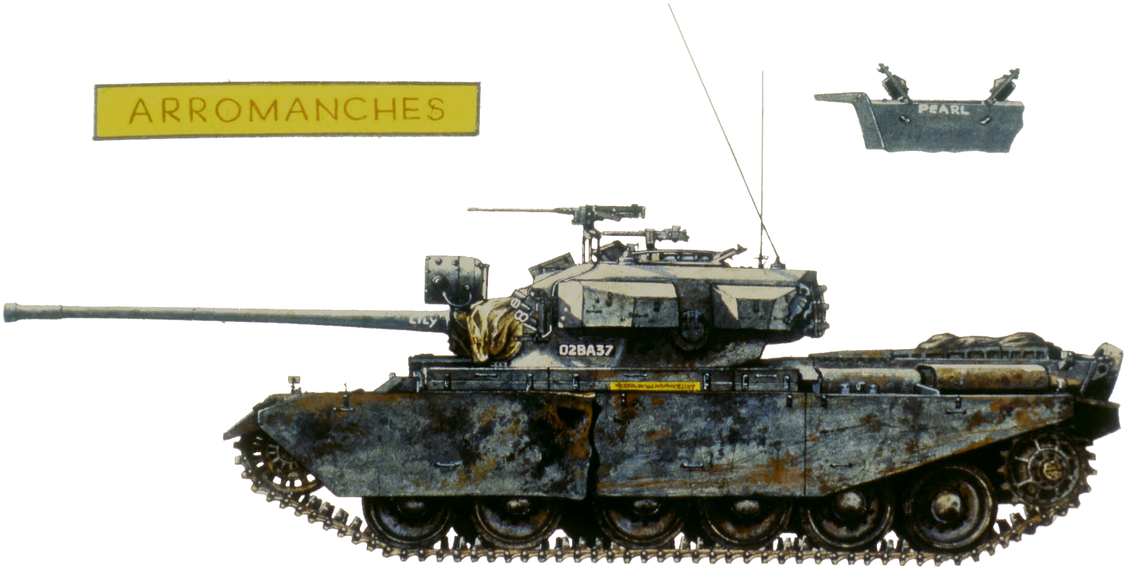


The accuracy of the Centurion 20pdr main armament was a major asset throughout the Korean War where it provided deadly fire support to the infantry and broke up many enemy attacks with its highly effective HE round. Here, CAPTAIN COTTLE of C Squadron Headquarters Troop, 8KRIH, engages targets on an enemy held hill in typical Korean terrain.

With the coming of spring, the UN forces began a series of concerted attacks that forced the enemy back to the 38th Parallel; the erstwhile international border between North and South Korea. On 22 April 1951, the Chinese communist forces and North Korean People's Army launched their Spring Offensive. The full weight of the assault fell upon the two British Commonwealth brigades on the Imjin River and at Kapyong. Against the most fearful odds, the enemy was held long enough for further defence lines to be established as the communists crashed against the British (and Commonwealth) hilltop infantry positions in repeated human waves never experienced before by the British Army, even in Burma. Fighting on widely separated hills, the 1st Battalion Gloucestershire Regiment, 1st Battalion Royal Northumberland Fusiliers and 1st Battalion Royal Ulster Rifles fought against impossible odds of over 15 to one. Nevertheless, British infantrymen in defence have few equals and they exacted a staggering level of casualties on the enemy before withdrawing after three exhausting days and nights under the covering guns of the artillery and the Centurions of the 8th Hussars on 25 April.

The corps commander arrived at 29 Brigade HQ at 1000hrs that morning and informed Brigadier Brodie that an attempt by the 65th Regimental Combat Team to relieve the Glosters had failed. This left Brigade HQ open to attack, as the Belgian battalion protecting the position was now heavily outnumbered. At 1030hrs the brigade was ordered to withdraw as the enemy pressure was too great. Ammunition and water were running low and radio batteries exhausted.

The Fusiliers started to withdraw under the covering fire of the tanks and escaped without further casualties. The first company of Ulsters also moved out without difficulty. The enemy threat from the north-west on the dominant feature of Kamak-San was very real and the road was under heavy and accurate mortar fire. The remainder of the Ulsters struck out south-east over the hills and so avoided the area of the pass. 1 Troop was now at the pass with the troop leader's Centurion perched like a chamois



CENTURION MARK 3 OF 3 TROOP, C SQUADRON, 1ST ROYAL TANK REGIMENT, COMMANDED BY SERGEANT A. WALLACE MM, THE HOOK, KOREA, 28 MAY 1933

ARROMANCHES, a mid-production Centurion Mark 3 of 1st Royal Tank Regiment, was commanded by Sergeant Wallace at the battle of the Hook. Finished in standard Deep Bronze Green, the tank is named after the French town of D-Day fame. Over the barrel of the 20-pdr is an American searchlight which was destroyed soon after battle was joined. On the barrel itself the gunner has painted the name of his girlfriend – 'Lily'. Several Centurions in Korea supplemented their firepower with .50-calibre M2HB Brownings, obtained from Americans or Canadians in exchange for Scotch or beer. A spare roadwheel is hung on the rear hull to replace any destroyed by gunfire. Note the damage to the front bazooka plate – it was not unknown for Centurions to be stripped of all bazooka plates, trackguards and stowage bins by enemy artillery. The vehicle registration number 02BA37 is displayed below the turret stowage bins on a black strip, and on the rear hull. On the front left trackguard (as viewed) and rear hull plate is the RAC flash with the unit serial '41' superimposed in white. The name of the driver's girlfriend, 'Pearl', appears on the glacis plate forward of his position. Sergeant Wallace was awarded the Military Medal for his gallantry in the Hook battle. The tank is painted in Deep Bronze Green rather than the earlier No.15 Olive Drab.

atop a small hill, lashing out at the enemy who were building up in the southern re-entrant to the west of the road. This was the critical hour. A wave of Chinese swept down from the hills all along the west of the valley, forcing the tank commanders to close down. Lieutenant Radford of 3 Troop, to the north, reported that the enemy was all over the valley floor. There was a very real danger that all the tanks would be trapped within this teeming cauldron. The Centurions ran the gauntlet of the treacherous ground. Sergeant Reekie's Three Able was knocked out by a white phosphorous grenade and Sergeant Holberton's Four Baker was disabled when, in an attempt to evade Chinese anti-tank teams, it careered over a steep dyke, spiking its gun in the ground.

Meanwhile 1 Troop was struggling to keep the pass open, ably supported by about 30 Sappers and the Ulster reserve company. As the last exhausted infantry trudged through the pass, 1 Troop pulled out, bringing some of the Ulsters with them as well as the Sapper escort. At this time the hard-pressed Belgians were ordered to withdraw under the covering fire of 2 Troop, which had given them excellent support all morning. As they pulled out with the Centurions firing over the rear decks at the advancing enemy, Two Able was stuck in reverse gear, crawling backwards at less than walking pace. When told of this Major Henry Huth, the squadron commander, gave permission for it to be destroyed, but the Belgian colonel refused. The rate of withdrawal slowed to keep station with the lame tank, which eventually reached the night-leaguer area where the Centurions came under Major Huth's direct control.

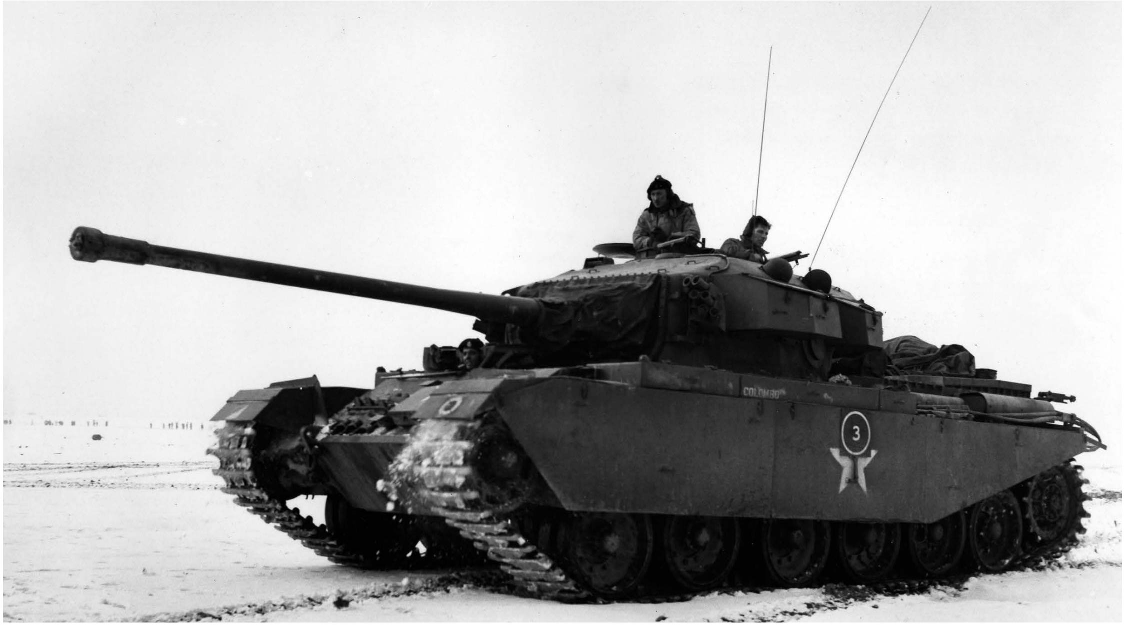
At the same time, 'Ormrodforce' had fought its way along the last lap of the valley through masses of Chinese troops, as 2,000 or more swarmed down from the west in an attempt to cut them off. The Centurions surged on, crushing the enemy under their tracks. Sergeant Cadman in Two Six Able, an RHQ tank, hearing a Chinese soldier battering on his cupola hatch, directed his Centurion through the wall of a building to brush him off and then ran over a machine-gun emplacement beside the road. Suddenly three platoons of enemy rose up out of a riverbed in parade ground order, only to be blown to oblivion by some of the last 20-pdr rounds. Some tanks took to the paddy fields. Few of the infantry riding on the rear decks survived this death ride. The tanks finally debouched from the valley and limped into the squadron leaguer area: 'the Centurions piled high with dead and wounded … blood ran down the sides turning the dust into crimson mud'.

Major Huth ordered 'Ormrodforce' to pass straight through to seek help for the wounded while he organized the withdrawal of the remainder of C Squadron. In an effort to speed the evacuation of 2 Troop's lame Able, Lieutenant Paul took it under tow. While the towline was being attached, Chinese machine-gun fire from the hills some 50 yards away struck an 88 white phosphorus grenade in the smoke discharger cups of the troop leader's tank CHAUCER (all the Centurions of the 8th Hussars were named after famous racehorses and steeplechasers). As the turret was traversed at the time, burning phosphorous flowed through the engine louvres, setting the engine on fire.

With the Chinese only 30 yards away the crews bailed out under covering fire from Major Huth. He then fired an AP round through each tank and quickly traversed his turret left to engage the fast-approaching enemy. For three deliberate minutes the turret of CAMERONIAN swung this way and that, firing long bursts of Besa into the Chinese. Only when it was absolutely necessary did Major Huth order his driver to retire. A hundred yards further back he was joined by Lieutenant John Lidsey on the other RHQ tank and together they continued the delaying action until there was an acceptable distance between the retreating infantry and the enemy. The two tanks then pulled back rapidly half a mile down the road to a new crisis.

Exhausted and wounded Ulsters were struggling towards the road from the hills to the east. Ordering those tanks which had halted in the vicinity to load to capacity with the infantry and withdraw, Major Huth and Lieutenant Lidsey moved forward again in an attempt to push the enemy back. For almost an hour the two Centurions fought a brilliant and courageous rearguard action. Each time the Chinese infantry were about to outflank the point tank it withdrew some 200 yards under the covering fire of the other. The Chinese followed the tanks in swarms at distances frequently less than 50 yards, quite oblivious to their casualties. In Major Huth's words 'We must have killed hundreds', but he measured his firepower against the speed of the approaching enemy so accurately that he imposed the minimum rate of advance upon them, allowing the infantry precious minutes to gain safety. Two other tanks eventually arrived to strengthen the rearguard, but not until the last infantryman was seen to reach the MSR, where more powerful firepower was available to them, did Major Huth give the order to withdraw. The last shot fired by Major Huth ended the battle of the Imjin River.

'Only the Glosters had not withdrawn. At dawn on the 25th, the Glosters with their dead and wounded about them were still on Hill 235. The guns of 45 Field Regiment had given them protection all night and before sunrise Colonel Carne told the drum-major to blow a long reveille. Roland's horn among the mountains, gathering



Recalled to the colours after World War II service in Burma with the 3rd Carabiniers, Lieutenant Mickey Radford commanded 3 Troop, C Squadron, 8KRIH, during the epic retreat from Pyongyang to below the 38th Parallel in the fearsome winter of December 1950. Here his Centurion Mark 3, 01ZR46 COLOMBO, manoeuvres over frozen ground on Seoul Island where the tanks of C Squadron covered the withdrawal of 29 Independent Infantry Brigade Group through the South Korean capital on 20 December 1950. Despite the bitter cold of the Korean winter, the Centurion performed admirably in temperatures as low as minus 16 degrees Fahrenheit.

echoes from centuries of battle, sounded again and the haggard soldiers on their blackened hilltop rose and cheered. Then the assault came in again…' That night the Glosters received permission to break out but, totally encircled by thousands of Chinese, few were able to do so, and the remainder was captured. The brigade had lost a quarter of its strength, but had it not been for the Centurions of the 8th Hussars it is unlikely that the Belgians, Fusiliers or Ulsters could have been saved at all.

The next battle of note was Operation Commando in October 1951, when the 1st Commonwealth Division staged an offensive to gain a series of hills to provide a coherent defensive line before the approaching winter. Its success was greatly enhanced by the extraordinary mobility and fire support of the Centurion tanks, which climbed seemingly unscalable heights to bring direct fire to bear on the enemy. The infantry assaults went in with the tanks' 20-pdr fire some 50 yards in front of them and Besa fire just 20 yards ahead, keeping the Chinese in cover until the last moment. Once these hills were captured they remained the frontline for the Commonwealth Division for the next two years while peace talks continued acrimoniously at Panmunjom. And it was on these very hills that the Centurions of the 5th Royal Inniskilling Dragoon Guards and 1st Royal Tank Regiment fought a curious war for armour as static pillboxes, providing intimate direct fire support to the infantry by day and night.

The Centurions' ability to scale the steep hillsides, combined with the unmatched accuracy of their firepower, won universal praise. In a tribute to the 8th Hussars on their departure from Korea, Major General John O'Daniel, commanding the US First Corps, said: 'In their Centurions, the 8th Hussars have evolved a new type of tank warfare. They taught us that anywhere a tank can go is tank country – even the tops of mountains.'

By the time the 5th Royal Inniskilling Dragoon Guards – the 'Skins' – relieved the Hussars in December 1951, the campaign had become static with the opposing armies entrenched on the high ground facing each other across the intervening valleys. The Centurions were dug-in among the infantry positions on the tops of hills. The tanks were protected from shellfire by sandbags and earth-filled ammunition containers. Crews lived beside their tanks in tents at first, and later, as enemy artillery fire intensified, in dugouts or 'hutchies' carved into the hillsides. There was no movement of the tanks except when squadrons were relieved or for occasional maintenance when vehicles were withdrawn below the skyline.

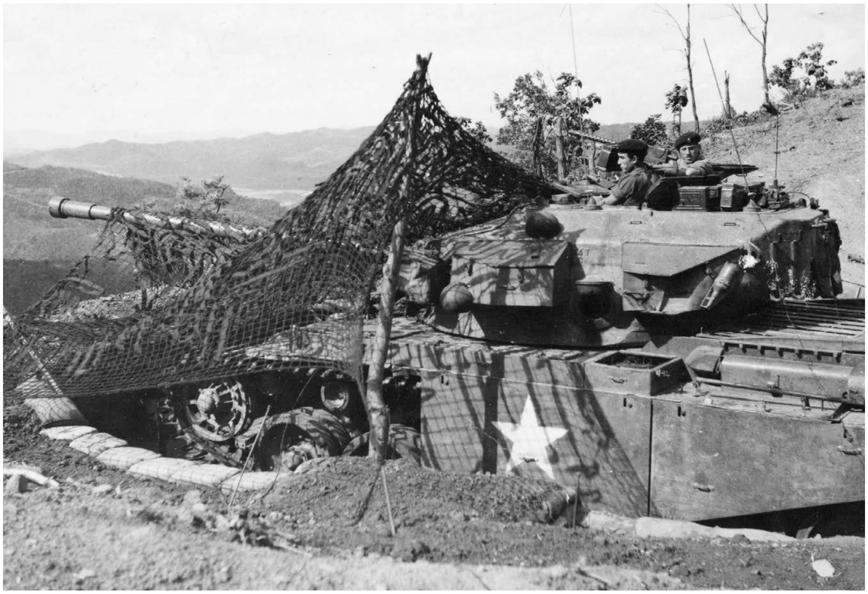
During the day, tank crews kept constant watch through binoculars for signs of enemy activity. Any fresh diggings, bunkers or trenches were engaged by 20-pdr HE gunfire. Within a short time the crews knew the dispositions of all enemy earthworks and the exact range to each of them. Any enemy unwise enough to show himself during daylight was liable to suffer a 20-pdr round or a volley of machine-gun fire within seconds. Similarly, UN soldiers did not venture above ground for fear of communist artillery bombardment. By night, the situation was very different. Both sides patrolled aggressively in no-man's land up to the opposing lines. Ambushes were set and limited raids undertaken. In all cases, the tanks acted as fire support, engaging pre-selected targets as dictated by the infantry. Prior to an infantry patrol, the tanks would register on likely trouble spots and potential ambush sites. The range, azimuth and angle of declination were established in daylight during normal harassing shoots and recorded for later reference. Each scheduled target had a codename or number and it took only seconds for a tank to execute the fire plan as indicated by an infantry patrol in no-man's land.

Against massed enemy infantry attacks, which invariably occurred at night, the supporting fire of the tanks was an important addition to the divisional artillery. Several Centurions were fitted with American searchlights above the main armament in order to illuminate enemy patrols in no-man's land. Tanks normally operated in pairs, with one to bathe the suspected area in light while the other engaged the target with HE. The searchlights were vulnerable to small-arms fire and artillery fragments and required the main engine to be run at high revs to produce sufficient electrical power.

The Chinese held no doubts as to the effectiveness of the Centurions and attempted to force their withdrawal from the hilltops. For five days in May 1952, a concerted firestorm of artillery rounds fell on the tanks. The Centurions received 45 direct hits during that time. None of the crews, secure inside the tanks, were injured and little damage was incurred beyond smashed periscopes, radio aerials, bazooka plates and stowage bins. Two tanks had to be evacuated but were quickly replaced. The enemy did not succeed in his objective, but such was the discomfort of the surrounding infantry under the heavy shellfire that some tanks were withdrawn below the skyline by day and only moved up to their fire positions at night. Other Centurions were covered by massive overhead field fortifications of railway sleepers and sandbags, known as 'elephant houses', which protected the tanks against mortar and medium artillery rounds.

Despite the almost static employment of tanks during this period, some armoured raids were undertaken, usually with limited objectives in mind such as the destruction of enemy positions hidden from direct fire. On 17 June 1952 Operation Jehu 5 was mounted by two troops of C Squadron, 5th Royal Inniskilling Dragoon Guards, with two infantry sections of 1st Battalion Princess Patricia's Canadian Light Infantry and a detachment of Sappers carried in two 'Tugs' (turretless Centurions used as personnel carriers, supply vehicles, and for medical evacuation). The objective was Point 156, which was believed to be a battalion position with numerous mortars on its reverse slope.

Early on 17 June Sappers breached the minefields and wire and by 0500hrs 1 Troop, C Squadron had crossed the start line while fire from B Squadron, Lord



By the end of 1951, warfare in Korea became static with both sides entrenched on opposing hilltops, in a constant war of artillery duels, ambushes and fighting patrols. The tanks were dug-in atop the commanding heights with wide fields of fire. From these vantage points, the tanks dominated no man's land and curtailed all movement during daylight. This Centurion Mark 3 of the 5th Royal Inniskilling Dragoon Guards is masked by a camouflage net to allow the crew to enter and leave the tank without being observed by enemy snipers.

Strathcona's Horse broke down the 'bund' beyond the stream which ran through the valley facing the objective; 1 Troop's passage through the paddy field and stream churned the area into a quagmire. Three Centurions of 4 Troop coming up behind were soon bogged. The advance was resumed by 1 Troop and the remaining tank of 4 Troop, with '1 Able' commanded by Sergeant James Bertrand leading. After destroying a mountain gun which had opened fire at close range, Sergeant Bertrand recalls: 'I found myself running up a fairly narrow spur with a long enemy communication trench dangerously near the tank track and, to cap it all, the danger of a bunker collapsing under the weight of a 50-ton Centurion was also a possibility.'

Baulked by a rocky spur 100 yards short of the final objective, the Centurions were still able to fire on bunkers normally hidden from friendly fire immediately received the full attention of all the tanks and the divisional artillery. At 0630hrs the order was given to withdraw, which meant, in the words of Sergeant Bertrand, 'a perilous return to our own lines. The route out through the minefield had unfortunately been blocked by a tank minus its tracks, thus necessitating a return over the face of Point 159 at a speed of about 3mph and through another of our own minefields. This of course delighted the enemy guns who, for what seemed like hours to the tank crews involved, had good targets to engage.' Within an hour the raiding force had returned safely except for the three tanks stuck in the valley below.

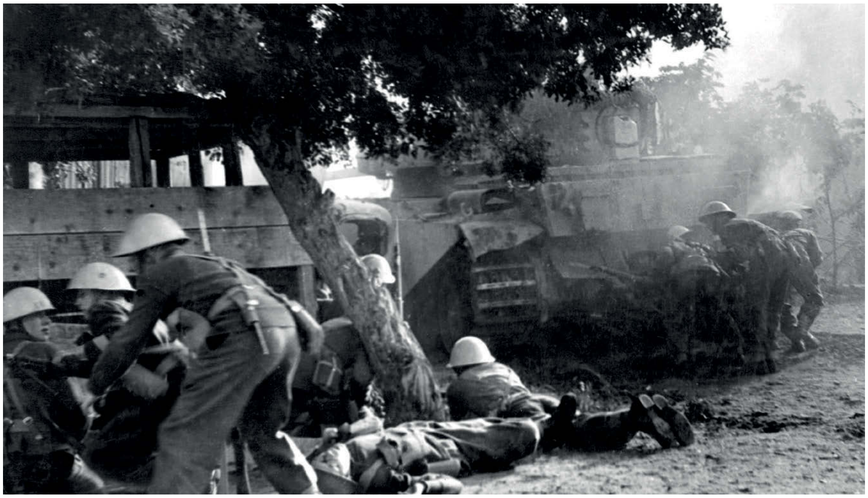
The recovery of these bogged tanks was an operation in itself. The first ARV on the scene ran over a mine as enemy artillery pounded the area. A second ARV was sent forward, but its winch rope was cut by shellfire and the REME officer directing the recovery operation wounded. A medical 'Tug' set out, but it too bogged down, bringing the total to 'five in the mire being shelled'. By dint of hard work under fire, three of the five were recovered by the end of the day. The recovery of the two remaining Centurions took several days longer. While infantry patrols guarded the tanks by night, Sappers cleared the minefields and bulldozed a new track under a continuous smokescreen from divisional artillery. Eventually ARVs were able to extricate the casualties. Despite the raid's undoubted success, the problem of the bogged tanks outweighed the damage inflicted on the enemy, and such raids were rarely repeated.

In December 1952, 1st Royal Tank Regiment relieved the 'Skins'. 1RTR continued the task of harassing the enemy and dominating no-man's-land. At night, the Centurions fired pre-registered Defensive Fire, or DF plans, to the front of infantry positions to counter enemy attacks and in support of friendly patrols. Infantry raids to capture prisoners and destroy field fortifications were also supported by tank fire. As peace negotiations continued into the summer of 1953, the Chinese mounted a fierce attack against a British hilltop position called The Hook in May. This position was held by the 1st Battalion Duke of Wellington's Regiment with C Squadron 1 RTR in support. Throughout the night action, the Centurions engaged the waves of attacking enemy and inflicted heavy losses, firing 504 rounds of 20-pdr HE and 22,500 rounds of Besa ammunition.

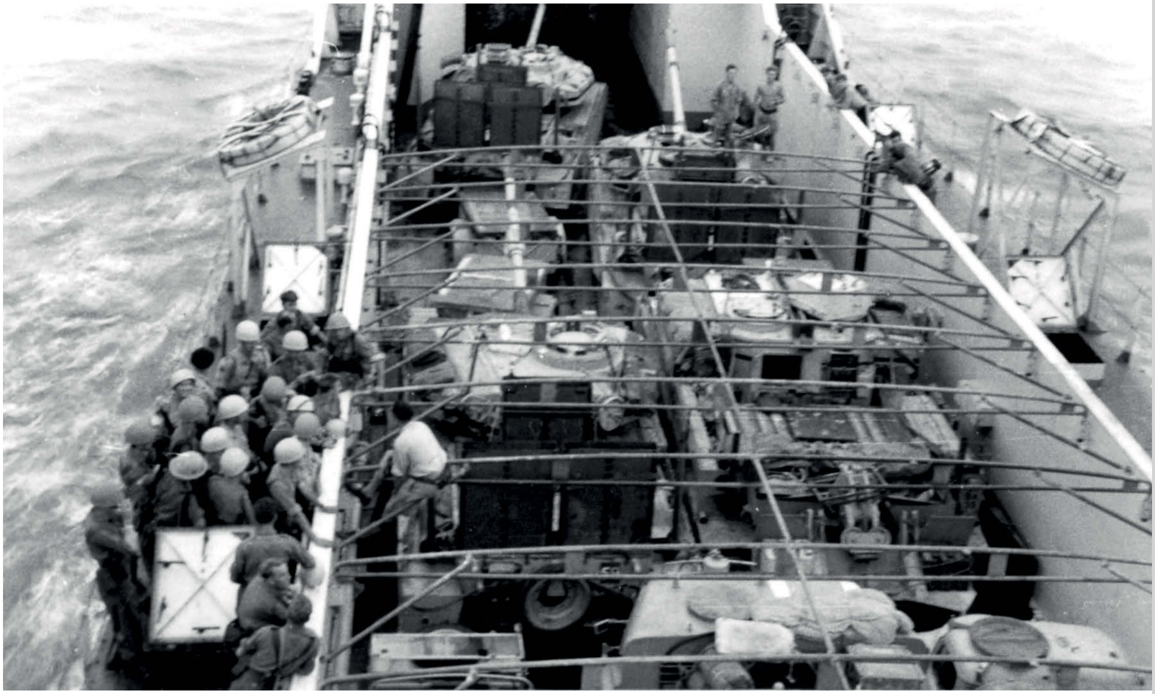
On the occasion of the Coronation of Her Majesty Queen Elizabeth II in June, the guns of the divisional artillery fired a *feu de joie* of red, white and blue smoke shells onto Chinese positions. As the smoke began to clear, all the Centurions in the frontline fired one 20-pdr round in a crashing salvo at a pre-selected target. In the following month, C Squadron supported the US 1st Marine Division to the left of The Hook as the Chinese recklessly sacrificed hundreds of soldiers in a final, futile attempt to capture the position. On 27 July a truce was signed at Panmunjon and hostilities ceased. The Centurion had proved itself in combat in no uncertain terms among the rugged hills of Korea, where its remarkable agility and fearsome firepower had often proved invaluable in support of the embattled infantry. In particular, the accuracy of the Centurion's main armament was decisive. In the words of Trooper Donellan of the 1st Royal Tank Regiment: 'We could hit any spot within a mile and a half in front of us, whether it was a range of mountains or a pheasant. If an army patrol heard movement or anything, they would radio a grid reference and we could put a shell down in a barrel of beer if they wanted it. That's how good the tanks were.'

OPERATION MUSKETEER: SUEZ 1956

On 26 July 1956, Colonel Gamil Abdul Nasser proclaimed the nationalization of the Suez Canal. Within days of the announcement the French and British governments decided on a joint military intervention to restore control of the international waterway. Three regiments of the Royal Armoured Corps were mobilized to meet the



In the early 1950s, the Suez Canal Zone was an area of continuing tension between Egypt and Britain as the latter wished to retain control of the international waterway. The British armed forces suffered a debilitating rate of casualties through ambush and abductions until drastic action was taken against the Egyptian auxiliary police that fomented much of the violence and terrorism. On 25 January 1952, tanks of 4th Royal Tank Regiment supported an attack by 1st Battalion Lancashire Fusiliers against the police station in Ismailia with the Centurion tanks breaking into the compound of the Bureau Sanitaire. Five Fusiliers were killed in the assault but Egyptian casualties were considerably higher.



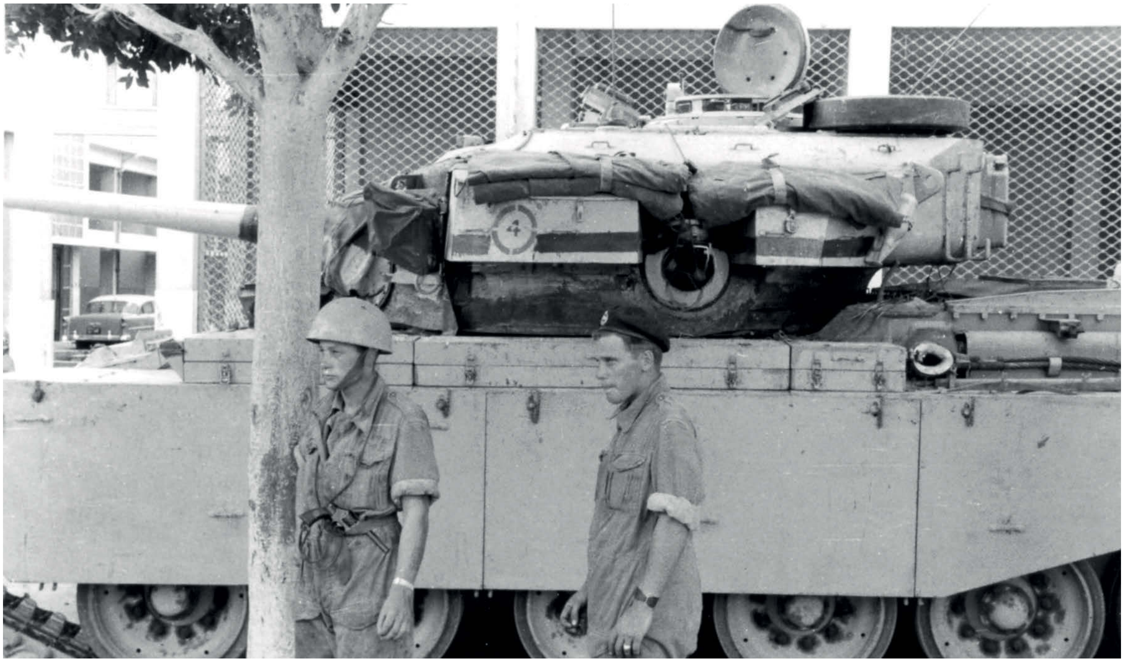
Dawn, 6 October 1956: an LCT carrying elements of C Squadron 6th Royal Tank Regiment approaches the beaches of Port Said at the outset of the seaborne assault during Operation Musketeer. The Centurions Mark 5 are fitted with metal trunking wading kits that are discarded by explosive charges once on the beach while the leading tank is towing two trailers packed with small arms ammunition for the paratroopers that had landed earlier

emergency. The 1st and 6th Royal Tank Regiments were to provide armoured support to the assault forces, while 7th Royal Tank Regiment equipped with unarmoured LVTs Mark 3 was to land 40 and 42 Royal Marine Commandos over the beaches. Both 1 and 6 RTR were considerably under strength. Throughout August equipment and vehicles, many of them lacking such essential fittings as wireless sets and ammunition racks, were drawn from the length and breadth of England.

As the stipulated assault regiment, 1 RTR received priority in equipment and training facilities while 6 RTR accepted what meagre resources remained. 6 RTR were able to achieve only one day of troop training on Salisbury Plain before both regiments were loaded on tank transporters for the journey to the embarkation ports of Plymouth and Portland. Due to the lack of RASC drivers and insufficient tank transporters, many of the Centurions were carried by civilian contractors. Working strict union hours, the drivers of British Road Services and Pickfords displayed a distinctly casual and dilatory attitude to the whole affair; on one occasion a Centurion, fully stowed with ammunition and machine guns, was parked unattended in a roadside lay-by for a whole weekend while the lorry driver retired to the local hostelry.

Considerable delay and confusion arose at the ports. Due to conflicting movement orders 6 RTR set sail first for Malta with 45 Centurions Mark 5 aboard the naval LSTs HMS *Suvla*, *Salerno*, *Ravager* and *Puncher*. On arrival the tanks were quartered on the Marsa Club No. 2 polo pitch, much to the dismay of the expatriate sporting fraternity, who saw their playing field disintegrate under the wheels of the supply trucks. After long weeks of intensive training and growing frustration the invasion force was called to readiness on 27 October and Operation Musketeer finally got under way.

At 0415hrs on Tuesday 6 November the LCAs and LVT Buffalos of 7 RTR carrying 40 and 42 RM Commandos formed up and churned towards the shore while air strikes and naval gunfire pounded the beaches at Port Said. Behind them came the LCTs carrying the Centurions of C Squadron 6 RTR. Against a pall of

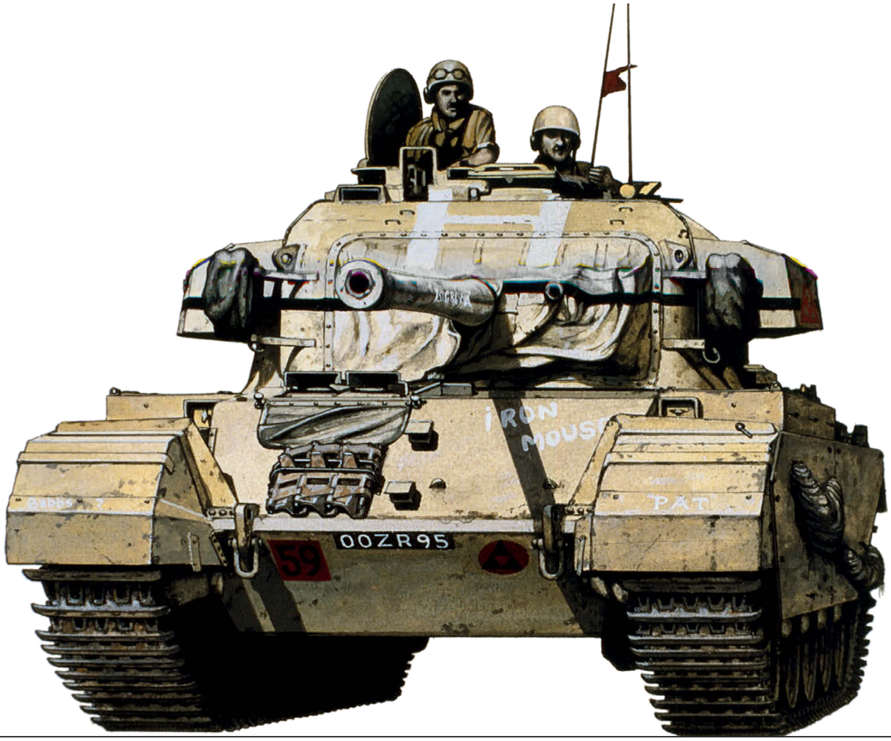


The Centurion Mark 5 of 12 Troop Leader stands by as surrender negotiations are conducted with the Egyptian garrison commander locked inside the Italian consulate. When discussions faltered, the Centurion was driven through the front door of the building and the Egyptians agreed to a ceasefire in short order.

black smoke from burning storage tanks, the LCTs gently beached 150 yards offshore and the Centurions rumbled down the ramps into 6ft of water. As the tanks rolled ashore the explosive charges retaining the waterproofing equipment were detonated. Unfortunately short circuits and corrosion of the explosive securing bolts after practice landings in Malta prevented the removal of exhaust and air intake stacks from six of the 14 tanks and the crews were obliged to dismantle the wading kits with crowbars and sledgehammers under sporadic Egyptian small-arms fire, much to the amusement of Marines sheltering in the lee of the Centurions.

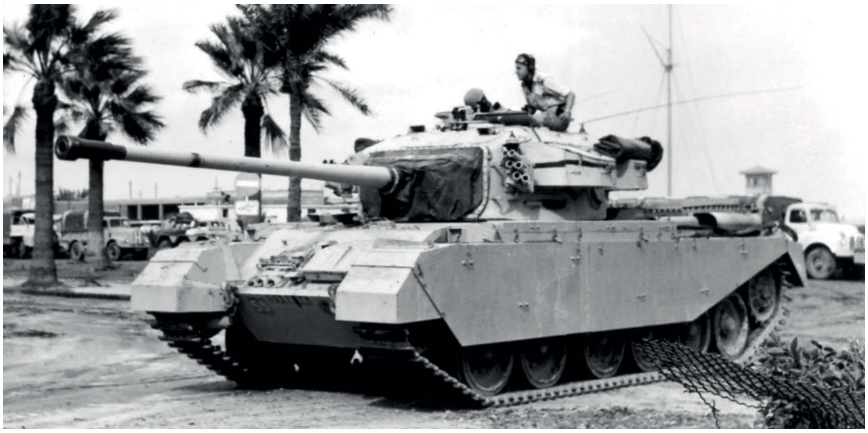
Within minutes of landing the tanks repelled an Egyptian counter-attack; and after securing the beachhead 9 and 10 Troops together with the OC of C Squadron, Major John Joly, advanced into the town with the Commando LVTs. Moving at speed, the column came under heavy small-arms fire from the side alleys and buildings lining the main street, Sharia Mohammed Ali. The Royal Marines in their unarmoured LVTs suffered several casualties. Unable to elevate their co-axial machine guns sufficiently, the tanks were prevented from returning the fire to the enemy in the upper storeys and the lack of cupola mounted Brownings was sorely felt. The crews of three 57mm anti-tank guns impeding the advance near the Egyptian Police Club were killed by the stabilized Brownings of the leading Centurions of 9 Troop under Sergeant Lumsden. Once out of the town the tanks formed defensive positions covering the golf course and dock areas, preventing the arrival of enemy reinforcements from the south until they were relieved by B Squadron during the afternoon.

On the other flank, 40 Commando with 11 Troop in support were clearing the waterfront and dock basins, but their rate of progress was necessarily slow. Each building had to be systematically searched and secured, while the maze of side streets afforded the enemy numerous avenues of infiltration and escape. By 0730hrs the Marines had advanced some 1,000 yards to the area of the Commercial Basin. Suddenly two Coca Cola trucks loaded with enemy infantry charged round a comer into the path of 11 Troop. The first was completely destroyed by a 20-pdr HE round



CENTURION MARK 5,1 TROOP, A SQUADRON, 6TH ROYAL TANK REGIMENT, COMMANDED BY CORPORAL STURGESS, OPERATION MUSKETEER; TREATY ROAD, SUEZ CANAL, 6 NOVEMBER 1956

The Centurions of 6th Royal Tank Regiment during the Suez landings were Mark 5s reworked from Mark 3 standard, with the substitution of the co-axial 7.92mm Besa machine gun by the .30-calibre Browning. IRON MOUSE is finished in overall sand yellow and illustrates the markings peculiar to Operation Musketeer. On the forward slope of the turret roof is painted a large white 'H' – an air recognition sign; emblazoned on all French and British vehicles, the 'H' stands for Hamilcar, the original name given to Operation Musketeer. The black stripe around the turret is a mutual recognition device carried by French and British tanks, a necessary precaution as the Egyptians were known to have some Centurions in service. On the turret side bins the squadron triangle symbol enclosing the vehicle callsign 'Four Bravo' follows the standard pattern, with 'Four Bravo' signifying the third tank in 4 Troop. In 6 RTR troops are numbered sequentially, e.g. 11 Troop is 3 Troop, C Squadron. The markings of A Squadron are red, as is the aerial pennant. Squadron colours follow the code of armoured regiment seniority. The long weeks of waiting in Malta prior to the landings are reflected in the numerous names applied to the tank. On the left front trackguard (as viewed) is 'BABBS?' – suggesting a degree of doubt on the part of the crewman as to the constancy of the young lady's affections. 'PAT' (right trackguard) and 'BIG BERTHA' (midway along the gun barrel) are painted in more confident style. To the left of the vehicle registration number 00ZR95 is the unit insignia, and to the right the formation sign of 3rd Infantry Division – the 'Iron Division'.



A Centurion Mark 5 of B Squadron 6 RTR stands guard at the regimental replenishment area in Port Said where the squadron provided armour support to 42 and 45 Royal Marine Commandos operating in Arab Town. Around the turret is the black stripe carried by all British and French tanks as a mutual recognition device, as the Egyptians were also equipped with Centurions.

A pair of Centurions Mark 5 of A Squadron 6 RTR advances out of Port Said towards the roads bordering the Suez Canal. The large white 'H' air recognition sign on the turret roofs is readily apparent on these tanks. The H stands for Hamilcar: the original codename for Operation Musketeer.

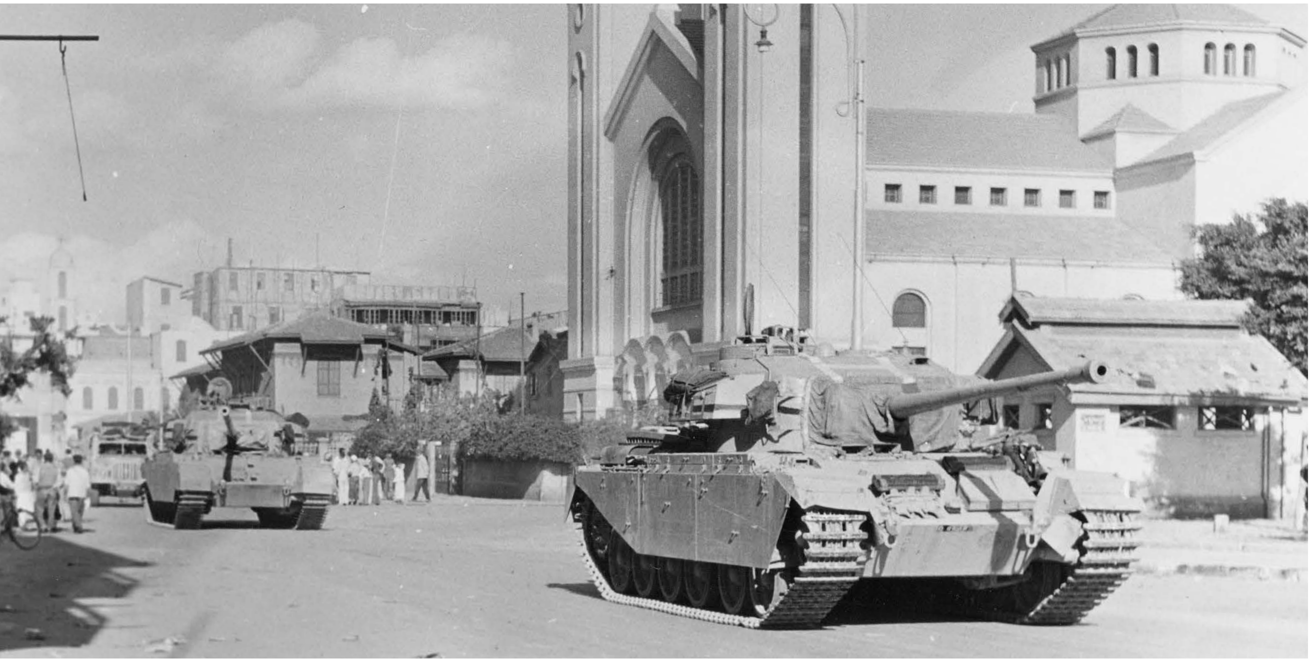
at 200 yards; the other, riddled by Browning fire, careered out of control into the canal. An hour later, with the capture of the Canal Company offices, 40 Commando came under heavy fire from Navy House across the Arsenal Basin and the advance faltered due to lack of infantry. The gates of the Arsenal Docks leading to Navy House were demolished by the Centurion belonging to 11 Troop commander, Lieutenant H. Leach, and a timber yard concealing ammunition was set ablaze. Even so, fierce fighting continued and the stubborn resistance from Navy House was not finally subdued until mid-afternoon, when a Fleet Air Arm strike with rockets and cannon ignited the building.

While the battle raged in the streets a Centurion and section of Marines had been despatched to relieve the British Consulate, where the staff was held under house arrest. The mission was successful, and the tank crew was suitably rewarded with tea served through the window by the Consul's butler. The Consul, his wife and their pet spaniel were then evacuated in a Saracen ambulance. At the same time 12 Troop, with the commanding officer of the Royal Marines, Brigadier Madoc, approached the Italian Consulate, where the Egyptian military governor was sheltering. The barred and shuttered doors proved an impediment to ceasefire negotiations, so the troop leader, Captain Tim Green, drove his Centurion up the steps of the portico into the hall, whereupon the Egyptian commander volunteered to accompany Madoc to Brigade HQ.

Centurion Mark 5 Four Alpha of A Squadron 6 RTR pauses on the Suez Canal road with paratroopers of *1er Régiment Étrangere Parachutiste* in support. The Centurions of A Squadron led the rapid advance down the canal road but the ceasefire was declared before their objectives were fully achieved.

By 0900hrs, the LSTs Ravager, Puncher and Salerno carrying A and B Squadrons and Regimental HQ had docked beside the Casino Palace Hotel and the tanks were disembarked. Severe congestion in the beachhead delayed their progress. It took an hour and a half for 3 and 4 Troops and A Squadron HQ to negotiate the crowded streets along the waterfront, past the railway station to the golf course. As the tanks crossed the railway line the leading Centurion, '4 Alpha', was strafed with cannon by a 'friendly' aircraft. Fortunately, little damage was incurred beyond a 20mm shell embedded in the hull and the wrath of the tank commander, Sergeant Jacknik. Further misfortune struck almost immediately as the tracks broke through the crust into the slime beneath. Within minutes four Centurions were bogged and, as the Squadron ARV was delayed in the town as a result of the fighting around the Arsenal Basin, the tanks were stranded. Meanwhile, 6 and 7 Troops of B Squadron under Major J. Allen were involved in fierce street fighting in the area of El Abbasi Mosque in Sharia El Mahrusa and the Arab Town in support of 42 and 45 Commandos. 5 and 8 Troops under Capt. C. Prateley set off to the gas works to relieve 9 and 10 Troops of C Squadron, who were in desperate need of replenishment.

It was not until 1345hrs that the bogged tanks of A Squadron were recovered. Shortly afterwards the advance was resumed down the canal roads, with the support of redoubtable French Foreign Legion parachutists crouching on the backs of the Centurions. As darkness fell the force reached the canal station of El Tina and the infantry dug in while the tanks refuelled. Here they were joined by Lieutenant Colonel T. Gibbon and his Regimental HQ at 2100hrs. By now rumours of an impending ceasefire were rife and the force commander, General Stockwell, ordered the advance to continue as far south as possible. Using captured Egyptian lorries and all available transport, 2nd Parachute Battalion reached El Tina at 2300hrs, where the two leading companies clambered aboard the Centurions. Driving without lights, the column motored at top speed down both canal roads and covered seven miles in 45 minutes, stopping to clear the canal stations of El Tina and El Gap on the way, before halting at



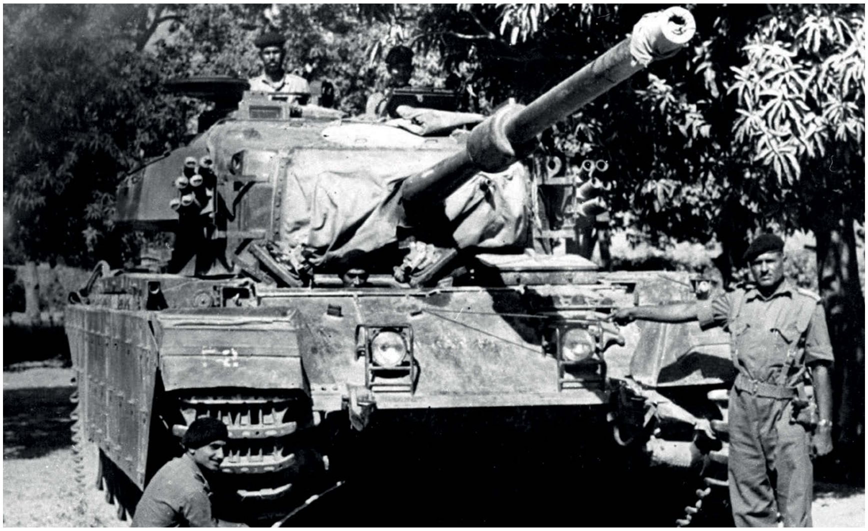
A pair of Centurion Mark 5s of B Squadron, 6 RTR, patrols the streets of Port Said after the ceasefire following the Anglo-French invasion to restore control of the Suez Canal in November 1956. B Squadron was involved in fierce fighting in support of Nos 42 and 45 Royal Marine Commandos during the initial assault.

midnight some 1,500 yards south of El Cap when the ceasefire was declared.

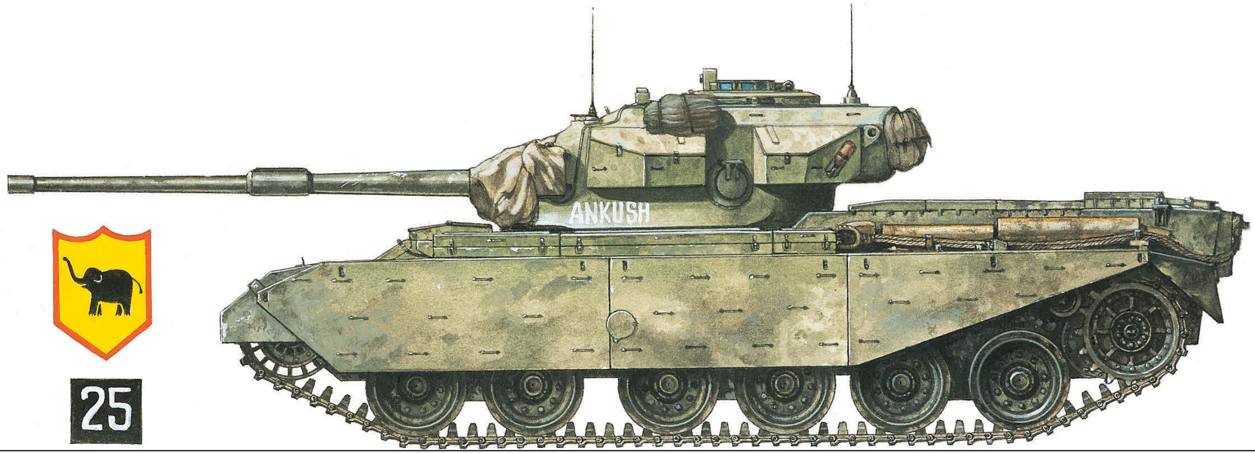
L-Day + 1 dawned bright and clear with the regiment busily engaged in much needed maintenance and replenishment. At El Gap the monotony of the afternoon was broken by the incident that became known as the 'War of Jacknik's Ear'. Sergeant Jacknik was in the turret of the point tank, '4 Alpha', helping his operator Trooper Clark repair the wireless set, while Corporal Charlton, the driver, was preparing a meal on the canal side. Beside him the gunner, Trooper Harty, cleaned the .30-calibre Browning machine gun. Some 100 yards behind, the crew of Centurion '3 Alpha' observed a party of 25 armed Egyptians moving cautiously along Treaty Road from the south. Despite frantic endeavours to attract their attention the crew of '4 Alpha' remained oblivious of the enemy's approach until the patrol was almost parallel to the tank. Hearing voices, Sergeant Jacknik put his head out of the turret. The patrol leader shouted 'Hands up', only to receive a short Anglo-Saxon expletive in return, whereupon the patrol opened fire, a bullet nicking Sergeant Jacknik's ear. Dropping into the turret, he returned fire with a Sten gun while Sergeant Stebbings in '3 Alpha' fired one round of 20-pdr HE and a burst of Browning, killing two Egyptians and wounding others. These were the last shots fired by the Centurions of 6 RTR during Operation Musketeer.

INDO-PAKISTAN WARS 1965

Since Partition in 1947, friction between India and Pakistan over the disputed state of Jammu and Kashmir had been the cause of numerous incidents along the length of the border. In the summer of 1965, after a fierce three-week clash in the barren, uninhabited salt flats of the Rann of Kutch at the southernmost end of the frontier, Pakistan began a campaign of infiltration of Kashmir by armed irregular 'freedom fighters', with the object of fomenting insurrection among the predominantly Muslim population. In response, Indian infantry units crossed the ceasefire line on 24 August and seized two strategic hills in the area of Tithwal. Subsequently, the large salient opposite Srinagar was occupied: an area of approximately 250 square miles containing the important Haji Pir Pass, which was an alleged infiltration route of 'freedom fighters' from Pakistan. Open hostilities erupted on 1 September when Pakistan launched Operation Grand Slam against the Ghamb-Akhnur sector with



One of the many attributes of Centurion was its ability to absorb battle damage yet remain operational, as shown by this Centurion Mark 7 of 3rd Cavalry that was hit 15 times during fighting on the Lahore front during the Indo-Pakistan War of 1965.



CENTURION MARK 7 OF MAJOR GENERAL RAJINDER SINGH, GOC INDIAN 1ST ARMOURED DIVISION, NORTH PUNJAB, SEPTEMBER 1965

This Centurion Mark 7 was the tank of Major General 'Sparrow' Rajinder Singh, General Officer Commanding 1st Armoured Division in the Sialkot battles during the Indo-Pakistani War of September 1965. The vehicle registration number KX261 appears on the lower front hull and trackguard stowage bins. The trumpeting elephant insignia of 1st Armoured Division is borne on the front right trackguard. On the opposite side trackguard is the black square of Divisional HQ with the serial '25' in white. These insignia are repeated on the rear hull plate just above the level of the towing pintle. The elephant appears immediately to its left, '25' immediately to its right; immediately right of this is '^ KX/261' in two lines on a black background. Between the headlights and on each turret side is the vehicle name ANKUSH. This is the Hindu word for an elephant goad carried by a mahout to guide and encourage his charge, an appropriate name for a command tank. It was customary for only command tanks to display such names whilst regimental commanders named their tanks after battle honours. The pale yellow solid circle air recognition sign on the turret roof enlivens the overall drab green colour scheme.

two armoured regiments and an infantry brigade.

The initial Pakistani assault forced the two infantry battalions and a squadron of tanks defending the area to withdraw, but on account of unfavourable terrain and a lack of logistical support the attack faltered a few miles short of Akhnur, having gained approximately 190 square miles of Indian territory. The object of the operation was twofold: firstly, to occupy territory as a bargaining counter to the captured salient, and secondly to tempt the Centurions of the powerful Indian 1st Armoured Division from the Jammu area to the northern side of the River Chenab, where they would be forced to join battle with their backs to the fast-flowing, mile-wide river. The Indians did not rise to the bait, however, having no intention of committing their armour to such poor tank country, but instead decided to relieve the pressure by a counter-attack in strength further south towards Lahore in the Amritsar-Ferozepore area of Southern Punjab.

On 6 September, five columns, each approximately of brigade strength amounting to three infantry divisions with an independent armoured brigade in support, launched simultaneous attacks into Pakistani territory. The area was not ideal for armour as the soft low-lying ground was criss-crossed by irrigation ditches and small rivers; but the advance made rapid progress until it reached the main Pakistani defensive line of concrete pillboxes and gun emplacements on the Ichogil Canal. The canal was approximately 120ft wide and 15ft deep, forming a natural anti-tank obstacle, and despite some minor probes across it the Indian advance was contained.

On 7 September the Pakistanis counter-attacked in the Kasur area, over-running the forward Indian infantry positions and forcing a withdrawal until the attack was halted by artillery fire. On the night of 8 September, the Pakistani 1st Armoured

The Centurion Mark 7 of Major General Rajinder 'Sparrow' Singh, the Officer Commanding 1st Armoured Division, is loaded on to a tank transporter in North Punjab at the end of the Indo-Pakistan War of 1965. Note the circular yellow air recognition sign on the roof of the tank.

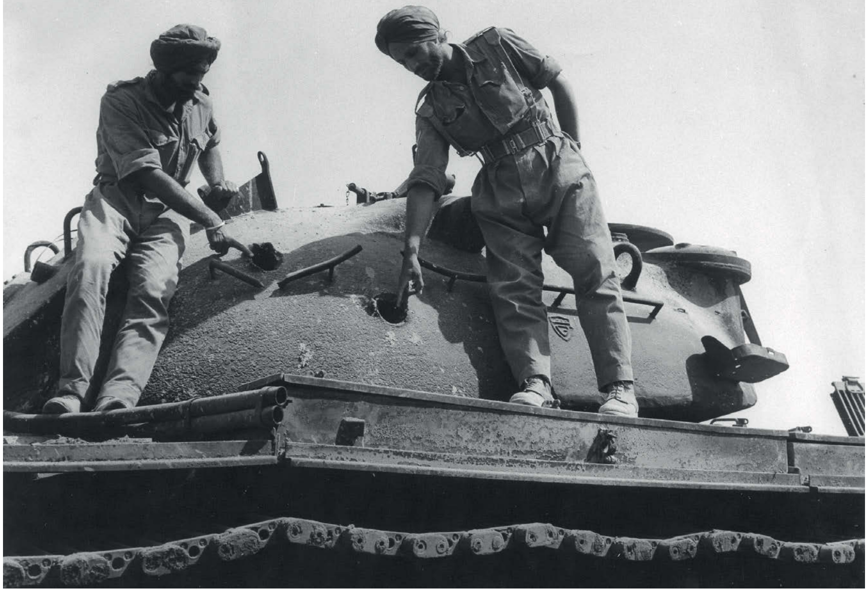
Division of 4th and 5th Armoured Brigades, with a supporting infantry division, opened a major offensive employing M47 and M48 Pattons fitted with infra-red equipment to shell Indian positions. The Indian tanks lacked such facilities for night fighting. During the next day and a half, the Pakistanis launched five separate attacks, culminating in one of the most decisive armoured engagements of the war at the battle of Assal Uttar, a small village near the market town of Khem Karan.

Indian armour and infantry fell back in face of the repeated attacks, luring the Pakistanis into a large horseshoe-shaped trap near the village. On the morning of 10 September, the Pakistanis committed the main strength of their armoured division with infantry in support. As they manoeuvred to outflank the Indian positions the tanks were hampered by the marshy conditions created when the Indians breached irrigation ditches and dykes. Spearheaded by M47 and M48 Pattons and flanked by M24 Chaffees and Shermans, the tank columns outstripped their lorry-borne infantry and were channelled into fields of tall-standing sugar cane, behind which the Indian tanks, including the Centurions of 3rd Cavalry, waited in hull-down positions. The high cane fields obscured visibility for the attackers, while the Indian tank gunners were able to track the Pattons by observing the waving sugar cane. Aiming a few feet below the exposed .50-cal. machine guns atop the turrets of the Pattons, the Centurions opened fire, exacting a deadly toll even before the surviving Pakistani tanks broached the cane fields into the open to become victims of the Centurions on their flanks. The trap was closed by the supporting fire of 76mm-armed Shermans and jeep-mounted 106mm recoilless rifles. A total of 97 tanks were destroyed or captured in the battle of Assal Uttar in what became known as the 'Patton-nagar' – 'Patton City'.

Meanwhile, the fighting on the Sialkot front farther north had developed into the largest tank battle since World War II. On 8 September, India mounted its main offensive from the Jammu area employing the 1st Armoured Division, equipped with three regiments of Centurions (Poona Horse, Hodson's Horse and 16th Cavalry), and two infantry divisions. Although the terrain was more suitable for armour than had been the case in the 'Patton-nagar' battle, the Indian tanks still outpaced their supporting infantry and clashed with the Pakistani 6th Armoured Division, which had similarly outrun its infantry. Over the next 15 days of almost continuous armoured action the two armies fought a bitter battle of attrition. A brief pause followed the initial clash. Fierce fighting then erupted in a series of armoured engagements known as the battle of Phillora, in which each side attempted to split the opposing forces and destroy them piecemeal. After the capture of Phillora by the Indians on the 12 September, both sides regrouped, reinforcing their armoured units from the Lahore sector and elsewhere. From the 14th to 17th there followed the battle of Chawinda, where tanks were committed to destroying tanks, both sides suffering heavy casualties. After this battle the fighting lost its ferocity but continued throughout the Sialkot sector until the ceasefire on 23 September.

These battles constituted the principal and most significant operations of the war. Both sides claimed victory in the conflict, but militarily it was a draw, with the Indians demonstrating greater tactical skill in the use of armour due to superior crew training. It must be realized that the Indian Armoured Corps had been seduced by Pakistani propaganda and entered the conflict in considerable trepidation, believing the Patton to be vastly superior in terms of firepower, protection and mobility to any tank possessed by the Indians. This concern was reflected in many of the official citations for heroism following the war, one of which commended an NCO for an action against 'several of the supposedly invulnerable Pattons'. Indeed, it appears the Pakistanis were victims of their own propaganda and believed the Patton to be virtually indestructible. This led to their rash tactics in assaulting Indian positions frontally and suffering proportionately higher losses among the Pattons, which invariably led their attacks. In the swirling dust of the Sialkot battles, Centurion fought Patton at ranges seldom exceeding 1,000 yards. The robust Centurion with its simpler fire control system proved superior to the M47 and M48 Pattons equipped with stereoscopic rangefinders and sophisticated ballistic computers.

Throughout the conflict the Indian Centurions employed the 'battle range technique' of fire engagement with telling effect. The 'three-round battle range' technique was a simple and rapid method of tank gunnery devised by Colonel Eric Offord during the 1950s when commandant of the RAC Gunnery Wing at Lulworth. In practice, the tank commander estimated whether the range to target was less than 1,000 yards. If so, he gave the fire order – 'Sabot action!' The loader loaded an APDS round, while the gunner took his initial point of aim on the target with 800 yards on the APDS range scale, and fired the main armament. Irrespective of whether the target was hit (and in all probability observation of the result would be impossible due to obscuration), the gunner automatically took a point of lay at 1,000 yards, shouting 'Add 200, firing now!', and fired again. Without pausing, he took a point of aim at 600 yards, crying 'Drop 400, firing now!' and fired the main armament yet



In the fighting against Pakistani M47 and M48 Patton tanks, the simpler fire-control system of Centurion often proved decisive, particularly in the defensive, when used in conjunction with the three-round battle range technique. This M48 Patton was burnt out following penetrations of the turret by 20-pdr APDS.

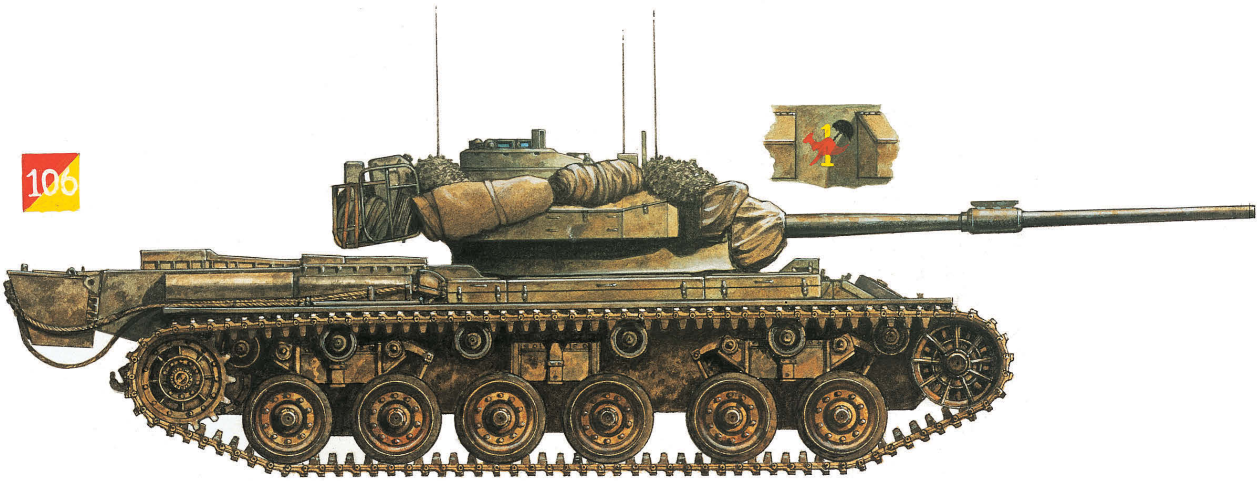
A Centurion Mark 7 of 16 Independent Armoured Brigade, comprising three Centurion regiments 4th Horse, 16th Light Cavalry and 17th Poona Horse, advances in a cloud of dust in the Samba region in December 1971. At the Battle of Basantar, 16 Brigade fought the most decisive tank engagement during the Indo-Pakistan War of 1971.

again. On account of the flat trajectory of the APDS round this ensured a hit at all ranges up to 1,000 yards and the three rounds were fired in under 20 seconds.

As a result of the heavy casualties they inflicted the confidence of Indian tank crews soared. When the Centurion proved able to absorb extensive battle damage and remain operational, it rose still further. A tank commander of 3rd Cavalry recalls how his Centurion rocked back on its suspension as if in recoil. Kicking his gunner in the back, he demanded to know why the main armament had been fired without permission, only to discover that the tank had been struck on the mantlet by a 90mm APCBC round at a range of approximately 1,000 yards which had failed to penetrate. Instances are known of Centurions surviving hits by HEAT projectiles, both 106mm and Cobra anti-tank guided missiles, with no more than the loss of a stowage bin or bazooka plates.

There is no question that both Indian and Pakistani tank crews showed considerable determination and fortitude in combat. Both sides were particularly effective when fighting from prepared defensive positions. It was at the higher levels of command that failures were evident, particularly in combined-arms operations when cooperation of armour and lorry-borne infantry was poor and even worse with artillery and airpower. According, the major offensives launched by both countries failed in their objectives and the war descended into stalemate.

The number of tanks employed by the Indian Armoured Corps during the war was approximately 600, including four regiments of Centurion with a total of 180 tanks. The Pakistanis employed some 775 tanks of which about 375 were M47 and M48 Pattons. The latter were constrained by a lack of comprehensive crew training, particularly on the complex fire-control system, and in the use of live ammunition in gunnery practice. Pakistani tank losses were approximately 200, of which 50 were left in Indian territory with half of those in a serviceable condition. Since India retained control of most of the battlefield terrain, more of the damaged tanks were recovered and total casualties were some 100 tanks of which 35 were Centurions. There is no doubt that Indian tank crews had a thorough confidence in the Centurion and their own technical ability and training, particularly in the three-round battle range technique. In battle simplicity is often the key to victory and survival.



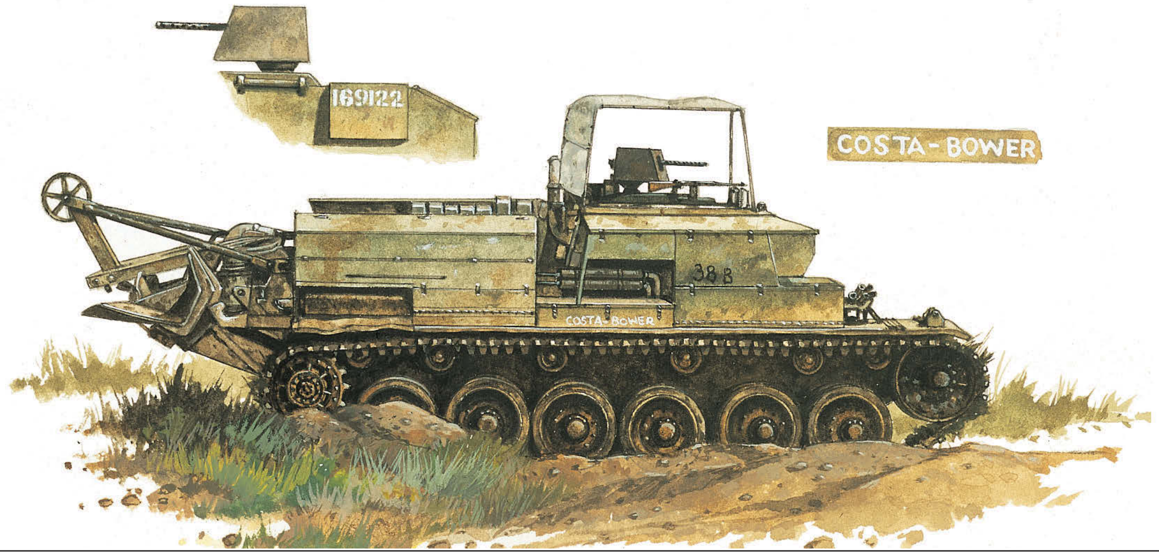
CENTURION MARK 5/1 (AUST), 1 TROOP, C SQUADRON, 1ST ARMOURED REGIMENT, ROYAL AUSTRALIAN ARMOURED CORPS, LIEUTENANT GERRY MCCORMACK, LONG DIEN, PHUOC TUY PROVINCE, SOUTH VIETNAM, SEPTEMBER 1968

In 1967, the Centurions destined for deployment to Vietnam were modified at the 3rd Base Workshops, Bandiana, with the addition of supplementary armour on the glacis plate, a 50-calibre Browning ranging gun, infrared night fighting equipment and a 100-gallon armoured fuel tank on the rear hull plate. Designated Centurion Mark 5/1 (Aust) for Australian, two troops of gun tanks were deployed to South Vietnam in February 1968. The vehicle callsign '31' is prominently displayed on the rear fuel tank and transmission decks. The numbers were clearly visible to an airborne observer guiding the tanks through difficult terrain. Denoting 1st Troop Leader of C Squadron, the callsign is repeated on a black metal plate attached centrally to the turret rear stowage basket. The registration number 169049 is painted in white on the rear fuel tank and top right of the glacis plate. Below the registration number is the arm-of-service flash of the Royal Australian Armoured Corps with the unit serial '106' superimposed in white. The flash is repeated on the top left of the glacis plate. Between the turret stowage bins is painted the insignia of 1 Troop – a yellow numeral '1' beneath a red leaping kangaroo surmounted by a black umbrella. The red kangaroo was initially painted on all 1st Australian Task Force but the South Vietnamese had never seen a kangaroo and had no word for the animal in their language so the Australians were nicknamed the 'Red Rats'. The addition of the umbrella reflected the troop leader's penchant for directing his tanks in battle while wielding his umbrella.

VIETNAM

In 1968, a tank squadron was deployed in support of 1st Australian Task Force in South Vietnam. The first elements of C Squadron, 1st Armoured Regiment, comprising two troops of Centurions Mark 5/1 (Aust) with support vehicles, landed at Vung Tau in February. Critics in the Australian Parliament and elsewhere doubted the viability of tanks in tropical conditions where, they believed, the paddy fields and impenetrable jungle would limit their effectiveness to the role of static pillboxes. Despite this scepticism the Centurions proved a success in numerous roles including fire support, perimeter defence, direct assault of enemy positions and, most importantly, infantry support. The infantry battalions were quick to appreciate the firepower of the Centurions as previously their only direct support had been from the .50-calibre machine guns of M113A1s.

After an initial period of training in infantry cooperation the tanks participated in Operation Pinnaroo to invest the Long Hai hills, a Viet Cong safe haven of long standing, situated in the south of Phuoc Tuy Province. Acting in the fire support role, the Centurions engaged bunkers and cave-mouths while the rifle companies penetrated the enemy base areas. The pin-point accuracy of the 20-pdr main armament enabled infantry units to co-ordinate their assaults against enemy positions to a much higher degree than was possible with the close air support of helicopter gunships or ground-attack aircraft.



CENTURION ARV MARK 2, C SQUADRON, 1ST ARMOURED REGIMENT, ROYAL AUSTRALIAN ARMOURED CORPS, COMMANDED BY SERGEANT PETER DE JONG RAEME, FIRE SUPPORT BASE 'CORAL', BIEN HOA PROVINCE, SOUTH VIETNAM, MAY 1968

Of all the specialized vehicles based on the Centurion, none was more important than the armoured recovery vehicle intended to retrieve disabled tanks from the frontline. In Vietnam, few tank operations were conducted without the support of an ARV and its companion M113A1 Fitter's Track. Manned by personnel of the Royal Australian Electrical and Mechanical Engineers (RAEME), the Centurion ARV Mark 2 was constantly in action both in the assault and for the recovery of vehicle casualties bogged in the mire of the Vietnamese countryside. Each tank squadron in Vietnam had the support of two ARVs rather than the one in peacetime operations. Soon after arrival in Vietnam, armoured extensions were welded to the rear stowage bins to provide protection from small-arms fire for combat engineers and tracker-dog teams who sometimes rode on the rear engine decks. A gun shield was also fitted to the commander's cupola-mounted machine gun. The base colour of olive drab is masked beneath the red dust characteristic of much of Vietnam. Markings are limited to the vehicle registration number 169122 at front and rear; the vehicle name COSTA BOWER and the callsign '38B'. The initial number denotes C Squadron; '8' the recovery section and Bravo the ARV: '38A' was the callsign of the M113A1 Fitters Track. '38B' is applied freehand on each side of the vehicle in subdued black so denying an aiming point to enemy RPG gunners. The vehicle name, painted freehand in neat white capital letters on the sides of the trackguard stowage bins, is Gaelic for 'Death Carriage', a mythical contraption driven by a headless horseman. Over the crew compartment is a nylon shade giving protection against sun and rain.

In May, during Allied operations to counter an enemy offensive against Saigon, the Centurions were a decisive factor in the successful perimeter defence of Fire Support Bases 'Coral' and 'Balmoral' against repeated North Vietnamese Army (NVA) assaults. In conjunction with artillery and air power, the canister fire of the Centurions decimated the attackers as they attempted to breach the perimeter wire. Discharging steel shards over a wide area at great velocity, canister is a cruel and devastating weapon against unprotected human beings. It also proved a most effective means of clearing the camouflage and vegetation which often concealed enemy bunker systems. Many engagements in Vietnam were fought against such systems, as the VC/NVA rarely initiated an action except from prepared positions. Often of great complexity and immense strength, the bunkers were all but invulnerable to artillery fire and infantry weapons. Without tank support the infantry were hard pressed to capture a position: but no bunker could withstand a pounding from APCBC solid shot at a few yards' range. Experience had shown that enemy bunkers, once taken, had to be destroyed to prevent later re-occupation. Demolition by explosives flown in by helicopters was time-consuming and not always feasible. In such cases Centurions were usually able to accomplish the job simply by crushing the bunkers beneath their tracks.

With guidance from an airborne observer, the Centurions were able to negotiate most of Phuoc Tuy Province in the dry season. During the monsoons they were still able to reach almost every area where they were required. Beside the many rivers and watercourses, the greatest impediments to mobility were the jungle forests of tropical evergreen and bamboo. Progress through such terrain was extremely slow. An advance through thick bamboo would be measured in hundreds of yards per hour, while petrol consumption was often as high as 12 gallons to the mile. Clinging vines and falling trees damaged trackguards and stowage bins, necessitating frequent replacement. Exterior fittings such as headlight assemblies and smoke grenade dischargers were often torn off entirely.

Similarly, despite fears of the enemy's effective RPG weapons, bazooka plates were soon discarded after arrival in Vietnam, as mud and vegetation compacted around the suspension units, distorting trackguards and stowage bins, which often lost their contents in the process. A remedy was found in replacing the original trackguards with steel plate of a thicker gauge. At the same time the stowage bins were reinforced and the bin-catches protected by welding mild steel angle along the sides. Spare roadwheels were fitted to the glacis plate, simplifying resupply and allowing speedy replacement after mine damage or an extended road run, when the high temperatures induced shedding of rubber tyres.

The enemy soon gained a healthy respect for Centurions' firepower and often withdrew from prepared ambush positions when an approaching infantry unit was accompanied by tanks. Deserters told of the terror felt by the enemy when opposed by Centurions. This fear was exploited by adopting a tactical manoeuvre known as 'the hammer and anvil'. The infantry would prepare ambushes on routes out of enemy-occupied territory. The tanks would then sweep through the area. The enemy invariably fled on to the guns of the waiting infantry.

Yet, against an enemy as courageous and resourceful as that faced in Vietnam, Centurions did not fight without loss. Throughout the conflict the principal weapon employed against AFVs was the mine, accounting for almost 70 per cent of vehicle casualties. Against the Australians the VC/ NVA used the standard ChiCom anti-tank mine, together with devices improvised from unexploded shells and bombs. Thanks to their external suspension units, Centurions survived ChiCom mines with relative impunity. Damage was usually restricted to a single suspension unit, which was readily replaced in the field with a spare flown in by medium-lift helicopter. The enemy soon realized the inadequacy of the ChiCom issue. In an operation against an NVA battalion strongly entrenched in an extensive bunker system in the north of Phuoc Tuy Province, they constructed some monstrous mines from artillery shells and explosives; yet, despite numerous attempts, only one Centurion was completely destroyed by such means. Several others were damaged beyond local repair, and these were returned to Australia to be renovated.

The other main anti-tank weapon in the enemy's armoury, the RPG, proved only moderately successful. Despite their initial fears, tank crews were relieved to learn that the Centurion was capable of absorbing RPG hits to the suspension, hull and turret and often remained operational. Unless a crew member happened to be in the direct path of a penetration the damage was often slight, all the vulnerable ammunition being stowed below the level of the turret ring and protected by the external suspension units. The spare road wheels on the glacis plate and the turret stowage bins were often sufficient to dissipate the effectiveness of the RPG. On 6 June 1969, an assault by Centurions of 3 Troop, B Squadron, against an entrenched VC/NVA force occupying the village of Binh Ba was met with a barrage of RPG rockets. In the ensuing action the tanks were hit numerous times, sustaining several crew casualties and appreciable damage; but they returned to the fray and, with the aid of infantry in M113A1 APCs, quelled the fierce resistance. One commander had a harrowing experience when ducking an RPG round: as it passed over his Centurion, his back was slashed by its fins.

Significantly, most casualties among tank crews were caused by rockets exploding above or on the outsides of the tanks. In the oppressive heat of the tropics tank crews rarely closed their hatches except in the direst circumstances. By firing RPGs into the trees above a tank or at the turret roof the enemy inflicted a number of serious casualties from the fragments and spall of an exploding rocket.

During Operation Hermit Park in June 1971 a composite troop of C Squadron (on its second tour of duty) was given the task of destroying a strongly held bunker system. As the tanks crashed through thick bamboo, the leading Centurion was struck twice by RPGs, destroying the cupola machine gun and seriously wounding the commander and wireless operator. Two other Centurions returned fire with canister and machine guns; one of these was hit by RPG fire, wounding the gunner. The fourth Centurion took RPG hits in the suspension and gun barrel from a concealed weapons pit.

As the enemy infantryman raised his rocket launcher once again the Centurion fired its main armament and the position disintegrated under the impact of an APCBC shell, which incidentally ripped 8in off the muzzle of the 20-pdr gun. The tank fired five more rounds of canister from its truncated gun, clearing the vegetation which covered the weapon pits; these were then silenced by machine gun fire.

Despite constant employment the ageing Centurions achieved a remarkable record of availability in Vietnam, rarely falling below 75 per cent. The devoted attention of tank crews and untiring dedication of RAEME LAD (Light Aid Detachment) and workshops ensured that continual demands from infantry units for tank support were met. Operational track mileages were considerable and squadrons covered in excess of 50,000 miles in a 12-month period. As part of the reduction of Australian forces in Vietnam, the tank squadron was withdrawn from operations in August 1971 and returned to Australia in September much to the chagrin of the infantry units still in action.

CENTURION IN IDF SERVICE

SHOT CAL

Even before the Six Day War, the IDF Ordnance Corps was addressing the deficiencies of the Centurion. In particular, its limited operational range and low speed were deemed to be the main disadvantages, although its firepower and armour protection were greatly admired and appreciated. The ageing Meteor engines had to be repeatedly rebuilt, while maintenance and engine replacement in the field were long and arduous and overburdened the repair facilities. The auxiliary assemblies, particularly the cooling system, posed frequent maintenance problems. In the desert, radiators became clogged with sand and oil while pulleys and drive belts failed with increasing regularity. The original air filters proved to be only partially effective in the Negev Desert unless they were flushed with fuel and filled with fresh oil daily – or in extreme conditions after every four hours of operation.

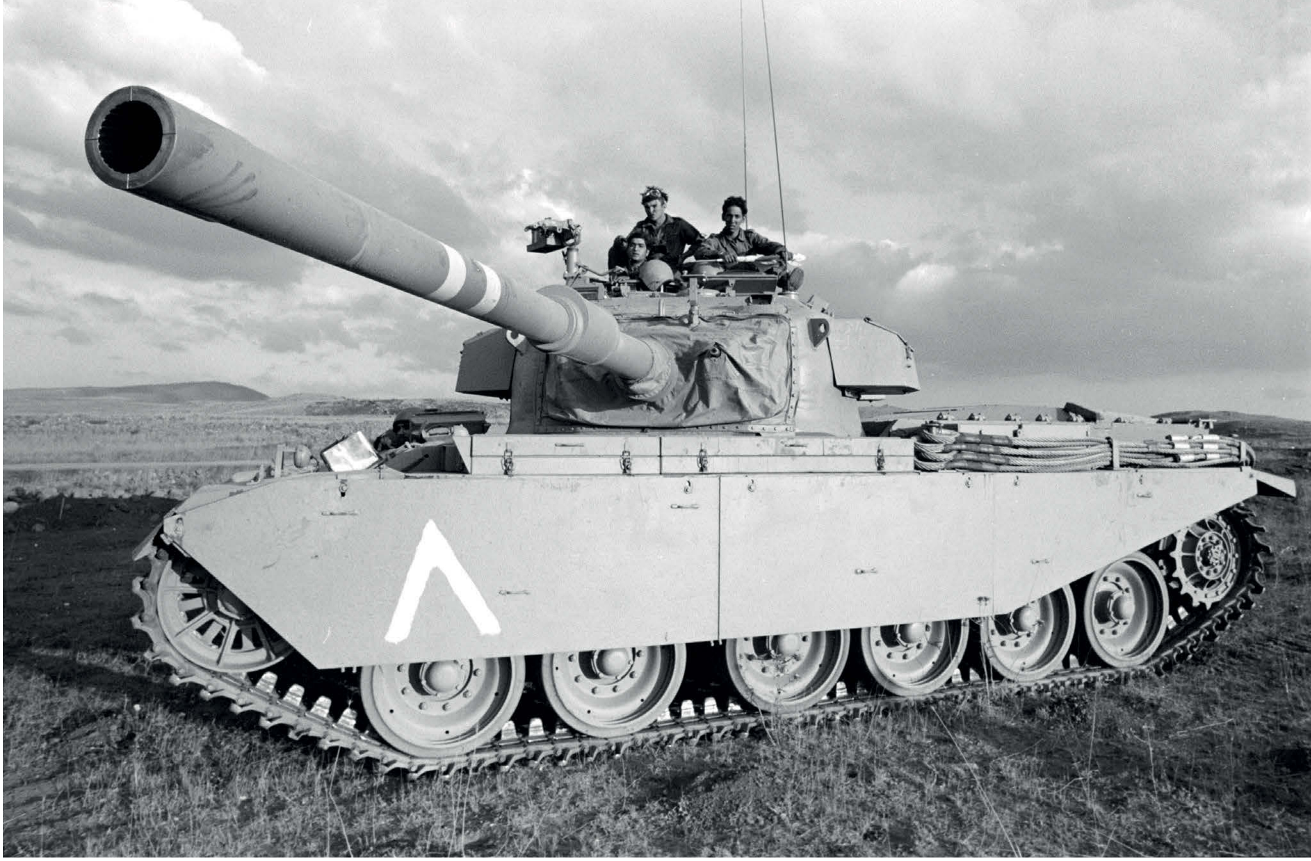
To overcome these problems, the Ordnance Corps devised an upgrading programme to improve its performance and reliability following its experience with the M50 and M51 Sherman conversions. In the words of the official publication by the Ordnance Corps on the project:

> What prompted the IDF, after having used the British Centurion Mk 5 for a number of years, to perform such an extensive operation and to completely reshape the old 'battle horse'? The answer can be summed in one sentence: the necessity to bring the Centurion Mk 5 which was built in the early '50s to the first line of the tanks of the '70s in regard to performance, reliability, maintainability and ease of operation.
>
> The primary requirement was to replace the gasoline-powered Meteor engine with a more fuel-efficient diesel power plant. The choice of engines suitable in terms of power, speed and operational range was limited to six, but none of these would fit in the existing engine compartment. During the course of development, three different engines were tested. Although all three alternatives were successfully installed and trialled, the Teledyne Continental AVDS-1790-2A air-cooled diesel was selected primarily due to standardization with the M48A2C Pattons that were being similarly modified in a separate upgrading programme. The adoption of this diesel engine had a number of further advantages including its ready availability on the international market, its lower fuel consumption by a factor of 1.7 and reduced fire risks in combat. At the same time, the Merritt-Brown Z51R gearbox was replaced by the Alison CD-850-6 automatic transmission that greatly eased the task of driving, particularly across country, and simplified driver training.
>
> As the selected powerpack was too large for the existing engine compartment, the rear hull had to be enlarged. Because of the increased fuel capacity requirements, intricately shaped fuel cells were developed to utilize all available space. Among the numerous other modifications were a more efficient oil-cooled braking system; fire extinguishers in the engine compartment of greater capacity, with a 10-second delay on actuation to allow the cooling fans to stop so that they did not disperse the extinguishing agent before it took effect; and increased ammunition stowage of 72 rounds, with more of them readily accessible to the loader.

In all, it took three years to develop the upgraded Centurion at the former British Army barracks of Sarafand, later the IDF Ordnance Corps depot at Tel Ha Shomer, near Tel Aviv. The Continental-engined tank was given the name Shot Cal or 'Whip' in Hebrew and earlier versions were designated Shot Meteor until such time as they were upgraded as well. The first Shot Cal entered service with the Israeli Armored Corps (IAC) in May 1970 and it soon saw combat during border incidents with Lebanon and Syria and during the War of Attrition along the banks of the Suez Canal. Within just one month of entering service, the Shot Cal fought its first major action when the 188th 'Barak' Armoured Brigade conducted a raid into Syrian territory in June 1970 during a four-hour battle with a Syrian tank brigade in which 36 T-55s were destroyed. But the Shot Cal was to fight its most desperate battles during the opening hours of the Yom Kippur War of October 1973 – once again in the hands of the Barak Brigade.

THE 100 HOURS WAR

Prior to the Yom Kippur War of 1973 Israel and its Middle East neighbours had engaged in a number of conflicts. In many cases armour had been the key to the



The crew of a Shot Cal of 77th Battalion 7th Armoured Brigade pose for the camera just hours before the outbreak of the October War on 6 October 1973. The loader of this tank had four tanks shot out from under him during the course of the war and he participated in the climactic battle for the Valley of Tears.

decisive battles and in the decades prior to 1973 there had been a protracted arms race throughout the region fuelled by the Cold War. Immediately before the Second Arab-Israeli War of 1956, the IAC was painfully aware of the limitations of its principal tank, the M4 Sherman. This was exacerbated by the massive arms deal of 1954 between Egypt and the Soviet Union that saw numerous AFVs being introduced into the inventory of the Egyptian Army. Among them was the powerful IS-3M, a tank that could not be penetrated by the IAC's most numerous tank, the standard 76.2mm-armed M4A1, which was known as the M1 Sherman in Israeli service. As soon as the IDF learnt of the Soviet arms deal, they approached the French for a means to upgun the M1 in a similar manner to the Sherman Firefly of World War II fame. By 1955, a prototype vehicle was produced by the Atelier de Bourges arsenal. It mounted the French CN 75-50 75mm gun, as fitted to the AMX-13, in a heavily modified Sherman turret on an M4A4 chassis. A modification programme began during early 1956 in Israel: it was to be the birth of a fledgling Israeli tank industry. The first new M50 Sherman was delivered to Company Bet of the 82nd Tank Battalion of 7th Armored Brigade for user trials and it saw combat during Operation Kadesh in the Sinai. The M50 also equipped two tank companies of the 27th Reserve Armored Brigade during the assault on the Gaza Strip on 1 November 1956.

The 100 Hours War that resulted in the conquest of the complete Sinai Peninsula was undertaken in collusion with Britain and France. Both countries wished to regain control of the Suez Canal after it had been nationalized by President Gamal Abdel Nasser of Egypt. The Israeli invasion of the Sinai was used as a pretext for an Anglo-French amphibious landing at Port Said at the northern end of the canal with the intention of occupying the whole Suez Canal Zone. As part of the Order of Battle, the British Army included a complete armoured regiment – the 6th Royal Tank

Regiment – equipped with Centurion Mark 5s. The initial assault landing of 6 November 1956 was supported by C Squadron, 6 RTR, whose Centurions were fitted with deep wading equipment and came ashore with the first wave of Royal Marine Commandos. The Centurions of 6 RTR were intended to thwart any Egyptian Army counter-attack with its recently supplied Soviet T-34/85s and IS-3Ms, or even the Centurion tanks supplied by the British in 1954. In the event, only a few SU-100 self-propelled guns were encountered and no armoured engagements ensued, although the Centurions of 6 RTR gave invaluable fire support to the Commandos throughout the day until a ceasefire was imposed by the United Nations at the instigation of the United States. Under intense political pressure, the Anglo-French forces departed Port Said by 10 December 1956.

Similarly, Israel was forced to evacuate the Sinai Peninsula and Gaza Strip by February 1957 at the insistence of the United States and Soviet Union. Nevertheless, the 100 Hours War brought about a fundamental change in the IDF perception of armoured warfare. No longer were tanks to be used largely for infantry support. Now due to their firepower and mobility, they were to become the main striking force during offensive operations in a combined-arms division-sized formation designated Ugda that differed in configuration depending on the tactical situation or the task in hand. To this end, more capable and modern tanks than the Sherman or even the M50 were required to fulfil the new armoured doctrine of the Israeli Armored Corps.

For political reasons, the Israeli government wished to procure M48 Pattons from the United States to forge a 'special relationship' between the two nations, although America had resisted such an arrangement for many years. Even so, permission was granted for M48A2C Pattons of the Bundeswehr to be transferred to Israel as part of German reparations for the Holocaust. A total of 250 Pattons was shipped to Israel between 1960 and 1964 including a quantity directly from the United States on a clandestine basis. Since much of the IDF's equipment including tanks and aircraft were produced in France, Israel wanted to diversify its arms suppliers as it did not fully trust any European government to be constant in the face of Arab political pressure, particularly in the provision of vital ammunition. Accordingly, Israel also approached Britain with the wish to procure Centurion tanks as a quid pro quo for involvement in the Suez campaign. After protracted negotiations, the first shipment of Centurions arrived in Israel in late 1959.

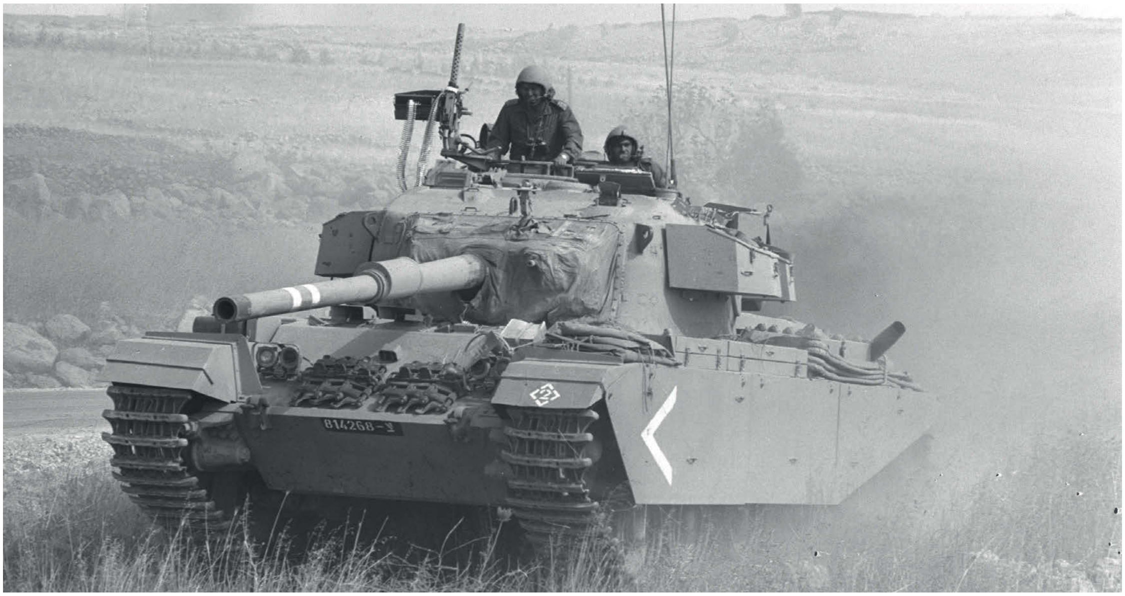
THE WATER WAR

The Centurion was the first modern main battle tank to enter service with the IAC. At 50 tons, it was much heavier and more complex than previous tanks. From the outset, problems were encountered with the tank, particularly when operating in the training areas of the Negev Desert. The abrasive dust caused air filters to clog, leading to engines overheating and on occasions catching fire, while brake failures were commonplace. Within a short period of time, the Centurion gained a woeful reputation within the IAC as temperamental and unreliable, reportedly 'more suited to English garden lawns than the Negev Desert'. However, many of the problems were due to inefficient maintenance procedures, particularly in the field, poor driving and inadequate training. An added difficulty was that many of the Centurions bought from Britain were second-hand and in need of refurbishment and rebuilding, but at that time the Israeli Ordnance Corps did not have the facilities to undertake such major work. The majority of the Centurion models procured were the Mark 5 version armed with a 20-pdr gun. When the Egyptian and Syrian armies began to receive the T-54 in significant numbers from 1962 onwards, the IAC sought a more powerful gun for its Centurions and Pattons. The answer was found in the outstanding British L7 105mm gun. It was simplicity itself to exchange the 20-pdr of the Centurion with the 105mm gun, as well as fit new graticule sights and ammunition stowage racks, since the British Army had undertaken this modification in large numbers. It was somewhat more difficult with the M48A2C Patton, as this required a more complex conversion. Accordingly, priority was given to the upgunning of the Centurion, which began in February 1962. By now the Centurion was called Shot in Israeli service. It first saw action along the Syrian border in November 1964 against dug-in World War II PzKpfw IV tanks and artillery weapons dotted along the dominating Golan escarpment that fired down on the Israeli settlements in the Huleh Valley and Finger of Galilee below. These encounters showed the need for improved gunnery procedures and the new commander of the Israeli Armored Corps, Brigadier Israel Tal, rigorously imposed these. Thereafter, the Syrians tried to divert the headwaters of the River Jordan in order to deprive Israel of a large proportion of its fresh water supplies. In what became known as the Water War, tanks were employed to destroy Syrian engineering equipment engaged in the diversion project. In time, the 105mm-armed Shots proved capable of hitting targets as small as a bulldozer at ranges out to 11km. It became the Tal credo of 'first shot, first kill, one shot, one kill' using the L7 105mm gun or 'Sharir' or Muscle. Such proficiency among the tank crews of the IAC was to prove decisive in the next major Arab-Israeli war as well as the conflict of 1973.

THE SIX DAY WAR

Although the Arab attempts to divert the headwaters of the River Jordan failed, incidents continued unabated along the Syrian border. Under Soviet encouragement, Syria persuaded Egypt to sign a mutual defence pact against Israel. Tensions rose during the spring of 1967, as Arab rhetoric demanded the eradication of the Jewish state. In May, President Nasser expelled the UN peacekeeping personnel from the Sinai and heavily reinforced the Egyptian forces stationed in the peninsula. When

A Shot Cal of the 179th Reserve Armoured Brigade advances across the rolling terrain of the Golan Heights intersected by stonewalls and basalt rock boulders that were particularly punishing for tracks and tank suspensions.



Iraq and Jordan joined the defence pact with Egypt and Syria, belligerent and hostile neighbours surrounded Israel. In a further flagrant act of aggression, Nasser closed the Straits of Tiran to Israeli shipping. On 5 June 1967, the IDF launched a devastating pre-emptive strike against the Arab air forces and effectively eliminated them in the first 24 hours. At the same, three Ugdas of the IDF poured into the Sinai Desert to strike the six Egyptian divisions, including the 4th Armoured Division equipped with T-54 and T-55 tanks, that were threatening Israel's border.

In the north, the 84th Armoured Division or Ugda Tal under the command of Brigadier General Israel Tal attacked the heavily fortified Egyptian positions at Khan Yunis and Rafah Junction. Ugda Tal was spearheaded by the elite 7th Armoured Brigade comprising 88 Centurions of the 82nd Tank Battalion together with the 66 M-48A2C Pattons of the 79th Tank Battalion. There were also Centurion battalions in the 200th Armoured Brigade of Ugda Yoffe and in the 14th Armoured Brigade of Ugda Sharon. The heavily armoured Centurions were invariably used to assault Egyptian positions frontally while the more mobile Pattons and Shermans manoeuvred around the flanks through the difficult sand dunes to mount attacks from unexpected quarters. One by one, the Egyptian defensive localities were attacked and overrun in a classic example of manoeuvre warfare while the great majority of Egyptian tanks were dug-in and immobile. By now the Israeli Air Force was pounding the hapless Egyptian ground forces as the tanks of the IAC surged westwards. In the first major tank battle between Centurions and T-55s, the Soviet tanks of the 4th Armoured Division were severely mauled by 20 Centurions of the 200th Armoured Brigade at the Bir Lahfan crossroads where 32 T-54s and T-55s were destroyed. Time after time, the 105mm gun of the Centurions proved devastating against the T-54/55, particularly at long ranges where the simple stadia sights of the Soviet design proved far less effective.

In five days of fighting in Sinai, the Egyptian army lost almost 80 per cent of its tanks including 291 T-54s, 82 T-55s, 251 T-34/85s, 72 IS-3Ms, 29 PT-76s, 51 SU-100s, 50 assorted Shermans and some 30-odd Centurions. By comparison, Israeli losses were 122 tanks of all types. Israeli Centurions also served in small numbers on the Jordanian and Syrian fronts during the Six Day War. Intriguingly, both the Egyptians and Jordanians were equipped with Centurions, albeit the Egyptians in small numbers, but there is no evidence that there were any encounters between the Centurions of the opposing sides nor any combat between IDF Centurions and Syrian T-54/55s on the Golan Heights. It must be said that the stunning Israeli victory during the Six Day War was as much to do with the incompetence of the Arab officer corps as it was to Israeli prowess in battle. The tactical handling of armour by the Egyptian army was uniformly inept and the T-54/55 was hardly given the opportunity to prove itself on the battlefield. Hundreds of usable AFVs were captured by the IDF and many scores of T-54/55s were pressed into service with the IAC under the designation of Ti-67 or Tiran. These were progressively upgraded over the years but they never proved popular with Israeli crews because of their cramped interiors.

After the war, the commander of the 200th Armoured Brigade, Colonel Yissacher 'Iska' Shadmi, had some illuminating comments to make about the campaign and his Centurion tanks:

> When I ask myself how it is possible that against the might of the Egyptian army, which my armoured columns had to face while continuously changing on the move, I was able to destroy 157 enemy tanks while our losses were almost nil – well, how did

> it happen? I have to give the following explanations. First of all, I agree with what has been said by the others before [regarding the superior training and tactical handling of the Israeli army]. Second, the air force. Third to my mind it was proved that the Centurion tank is by far superior to the T-55 and T-54 Russian tanks and especially in one aspect which gave our boys their self-confidence – the additional 20 tons of armour steel. And the point which in my opinion shows more than anything else how we did it were the stories about tanks that got five, six, seven hits – and there was one with 12 direct hits – and which continued to fight. But let me just tell of a few incidents. Two tanks which participated until halfway through the battles, limping along on half their tracks. They were hit by mines and damaged so they shortened their tracks and were able, at a slow pace, to continue the fight. One tank was hit by a direct 120mm [mortar] shell and its turret became immobile. The officer in command decided to keep this tank at the rear and so it advanced. At the battle of Jebel Libni this tank is credited with hitting two enemy tanks.

THE DEFENCE OF THE GOLAN HEIGHTS

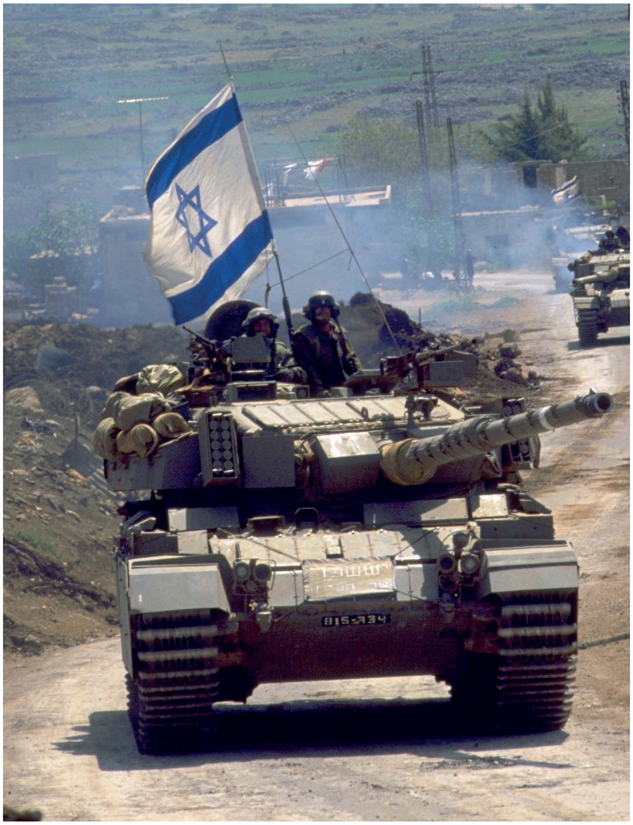
The decisive victory in the Six Day War of June 1967 greatly extended the borders of Israel following the capture of the Sinai Peninsula and the Golan Heights together with the West Bank and the Gaza Strip. For the first time in its history Israel now enjoyed the luxury of defence in depth. The speed and scale of the Israeli victory sent shockwaves through the Arab world. Israel had drawn the teeth of its bitterest enemies and its demonstration of military prowess had garnered respect around the world. Israel's position now seemed secure. However, Arab hostility remained implacable. The Khartoum conference of Arab leaders in August 1967 declared that there would be 'no recognition, no negotiations, no peace' unless Israel unilaterally withdrew from the territories occupied during the Six Day War. However, these very same conquered territories now gave Israel defensible frontiers and the IDF were loath to lose them without firm guarantees of lasting security. Furthermore, Israeli public opinion was in no mood to allow the spoils of this spectacular victory to be cast aside as had happened after the Sinai Campaign of 1956.

Within weeks, however, the Egyptians resumed hostilities along the Suez Canal with heavy artillery barrages against Israeli positions. To reduce the casualty rate, the IDF were obliged to construct a static line of field fortifications on the eastern bank of the canal that fatally compromised the recently gained advantages of strategic depth for defence. It also negated Israel's superiority in manoeuvre warfare, as tanks were now required to come to the aid of the field fortifications that became known as the Bar Lev Line. There ensued the bitter War of Attrition that continued until August 1970 but even after it ended the IDF strategy vacillated between a mobile defence of the Sinai Peninsula and a forward defence to protect the forts and occupants of the Bar Lev Line. The dilemma was never fully resolved prior to the Yom Kippur War of 1973, with dire consequences.

On the Golan Heights, the IDF faced different problems. The Israeli-occupied Golan Plateau was only 17 miles deep at its widest so a strategy of forward defence was essential as it was not feasible to trade space for time: time to allow IDF reservists to be mobilized and deployed to stem any Arab offensive. Fortunately, the volcanic terrain strewn with impassable lava flows of basalt rock favoured the defenders as only a few roads crossed the region. In addition, its numerous tels or extinct volcanic cones, up to 200m in height and overlooking the Damascus Plain where the bulk of the Syrian forces were stationed, made excellent vantage points for observation and firing positions. Only in the south was the terrain really suitable for tanks. The Israeli defences were based on the 'Purple Line' that ran from the Jordanian border in the south to the slopes of Mount Hermon in the north: the Purple Line took its name from the colour on UN maps that marked the zone of separation between the two belligerents following the Six Day War. Again, as along the Suez Canal, the ceasefire was repeatedly broken with the Syrians bombarding Israeli positions with artillery. Accordingly, the Israelis constructed a series of 12 infantry strongpoints called Mutzavim along the Purple Line. Each Mutzav was invariably on high ground with wide fields of view to allow constant observation of Syrian dispositions and movements. The Mutzavim were not intended as true fighting positions but primarily to direct artillery fire and close air support against any enemy incursion.

Over time, the Syrians adopted a prolonged campaign of harassment by artillery fire coupled with infiltration by infantry units to capture specific Israeli positions in order to inflict debilitating casualties upon the Israeli troops. On occasions, these escalated into full-blown attacks that became known as 'battle days' as they rarely lasted more than 24 hours. To counter such assaults on the Mutzavim, the IDF Northern Command that was responsible for the defence of the Golan Heights constructed tank-firing ramps beside the individual strong-points. These firing ramps dominated the surrounding terrain and allowed tanks to engage targets to well beyond 2,000m range. A deep anti-tank ditch protected by mines was dug along the Purple Line to deter encroachment by Syrian AFVs, but such measures were alien to the IDF armoured doctrine that advocated offence as the best form of defence. In time of war, it was axiomatic that the IDF would take the battle onto enemy territory and field fortifications did not sit comfortably with this strategy.

Following the Six Day War, the IDF had been seduced into the conviction that the tank was the primary weapon of ground warfare, supported by an all-powerful air force that would guarantee air supremacy. With a limited defence budget and the air force taking priority in all expenditure – 52 per cent of the total in 1973 – it was impossible to meet all the demands. In the army, the armoured corps took precedence over the other arms and so more tanks were procured at the expense of mechanized infantry vehicles or self-propelled artillery. At the time of the Six Day War there were 338 Centurions in service with the IDF. Many more were purchased on the international arms market – 90 in 1967, 100 in 1968, 120 in 1969, 120 in 1970, 120 in 1971 and 100 in 1972. Armoured brigades were now configured with up to three tank battalions but with no integral mechanized infantry component. A tank



Flying the national flag of Israel, a Shot Cal Dalat returns from an incursion into Lebanon in the continuing struggle against terrorist insurgents. The Dalat model was the final version of Shot Cal as a gun tank that featured a full array of Blazer reactive armour; an upgraded fire control system and a thermal sleeve for the 105mm gun. The panel on the glacis plate states 'Issichar is coming home'.

battalion comprised three companies with three platoons of three tanks, plus two more in company headquarters for a total of 11 in each company. With three tank battalions of 36, a fully organized brigade had 111 tanks including three in brigade HQ. Mechanized infantry was to be allocated depending on the mission within the overall Ugda or divisional plan.

Facing the Israeli forces deployed on the Golan Plateau was a Syrian standing army of three infantry divisions and two armoured divisions stationed within striking distance of the Purple Line. To the north was the 7th Infantry Division deployed from the foothills of Mount Hermon to Kuneitra where it linked up with the 9th Infantry Division that in turn linked up with the 5th Infantry Division at Rafid. These were infantry divisions in name only since each was composed of two infantry brigades, each with an integral tank battalion of T-54/55 tanks, together with one mechanized and one armoured brigade. There were therefore 180 T-54/55 tanks in each infantry division while the armoured divisions were each equipped with 230 of the more modern T-62 tanks armed with the 115mm smoothbore gun. In addition, there were 400 T-54/55s in independent armoured brigades to give a grand total of 1,400 tanks. These were supported by 115 batteries of artillery ranging from 85mm to 203mm, with a total of 950 guns with 70 to 80 guns per kilometre at the designated breakthrough points. Although impressive by any standards, this was still only half that stipulated by Soviet doctrine. The Syrian strategy was to attack in overwhelming force and recapture the Golan Plateau within 36 hours, as this was the time thought to be available before the Israeli reserves could be mobilized. Time was therefore of the essence for both sides. The Syrians had to complete their offensive before the reserves were deployed on to the Golan Heights while the Israelis had to fight a delaying action long enough for the reserves to be mobilized.

In the autumn of 1973, there was just one armoured brigade deployed on the Golan Plateau, facing some 1,400 tanks. The 188th ‘Barak’ Armoured Brigade – Barak is Hebrew for lightning – was a regular formation of two tank battalions with just 69 Shot Cal Upgraded Centurions. It was an absurd disparity of forces but the Israelis were the victims of their own hubris. Since the end of the War of Attrition, Israeli military intelligence, AMAN, was convinced that Egypt would not go to war until such time as its air force was a match for the Israeli Air Force and that would not be until 1975 at the earliest. Furthermore, Syria would not fight Israel without Egypt and therefore there was no possibility of all-out war for the foreseeable future. It was a concept born of arrogance and an abiding contempt for the fighting abilities of the Arab armies, particularly Syria. Accordingly, the IDF high command remained unconcerned that the force ratio on the Golan Heights was approximately 20:1 since some 70 Shot Cal tanks were deemed sufficient to deal with any ‘battle day’ given there was no real chance of war. Even in the most unlikely of circumstances that major hostilities broke out, AMAN had promised that it would provide at least 48 hours warning: more than enough time to mobilize the reserves. Anyway, the Israeli Air Force was on hand to support the ground forces and stem any assault from the outset.

On 13 September 1973, Israeli F-4E and Mirage IIICJ fighters were escorting a photoreconnaissance mission by RF-4E Phantoms tracking Soviet arms shipments to the port of Tartous. Syrian MiG-21 fighters were scrambled to intercept them but in the ensuing aerial combat 13 Syrian aircraft were shot down with just one Israeli loss. It was the pretext that allowed the Syrians to move their forces forward and adopt an offensive posture, which the Israelis interpreted as purely a public response to the catastrophic air battle. However, it prompted Minister of Defense Moshe Dayan to

A Shot Cal Bet without Blazer 'Baltans' stands guard overlooking the village of Ganata in southern Lebanon during Operation Litani River in March 1978. This tank belongs to 81st Battalion of 7th Armoured Brigade, the senior armoured unit in the Israeli Armoured Corps. Of note, it mounts an AN/VSS-3 IR/white Xenon searchlight for night fighting that was so sorely lacking on Israeli tanks during the October War of 1973.

visit the Golan Heights on 25 September, together with General Eli Zeira, the head of AMAN, and inspect the Israeli defences. On a tour of the frontlines, he was briefed by Major Shmuel Askarov, the deputy commander of the 53rd Tank Battalion of the Barak Brigade. At just 24, Askarov was the youngest deputy battalion commander in the army with a rising reputation. He stated unequivocally: 'War is certain'. Dayan turned to Zeira for his comments only to be told blandly that there would not be a war for another ten years.

Nevertheless, after consultation with Major General Yitzhak 'Khaka' Hofi, the GOC Northern Command, Dayan authorized the deployment of a single tank battalion of the famed 7th Armored Brigade from its base at Beersheba in the Negev Desert to the Golan Heights as reinforcement to the Barak Brigade. The 77th 'Oz' Tank Battalion travelled northwards on the eve of Rosh Hashana, the Jewish New Year, and was equipped with Shot Cals held in reserve by Northern Command. By 1 October, the battalion under the command of a dynamic Yemenite, Lieutenant Colonel Avigdor Khalani, was deployed on the Golan Heights with 22 tanks: the odds were now 15:1. General Hofi was now thoroughly alarmed by the Syrian build-up and he ordered that the anti-tank ditches be widened and deepened as well as the sowing of thousands more mines and for further tank firing ramps to be created on the hill features of Hermonit and Booster Ridge that dominated the Kuneitra Gap. It was here that Northern Command believed the Syrians would launch their main offensive if war broke out, as it would give them the shortest axis of advance to the main Israeli military base and headquarters on the Golan at Nafakh and from there onwards to the Bnot Ya'akov Bridge across the Jordan River. As a further precaution, Hofi replaced the reserve infantry battalions in the Mutzavim with hardened troops of the Golani Brigade in the strongpoints to the north of Kuneitra and paratroopers of the 50th Parachute Battalion in those to the south.

The Syrians were well aware of the dispositions of the Israeli forces on the Golan Plateau and made their plans accordingly, with the help of their numerous Soviet advisors. While the 7th Division was to tie down the Israel forces to the north of Kuneitra, the main attack was to be made by the 9th Division through the Kudne Gap via Hushniya to Nafakh and on to the Jordan River. Meanwhile, the 5th Division was to break through the Rafid Gap and exploit southwestwards down the South Road to El Al blocking any Israeli reinforcements climbing up the escarpment from the Sea of Galilee. Waiting in the wings were the powerful 1st and 3rd Armoured Divisions, ready to exploit any success with their potent T-62s and brand-new BMP-1 mechanized infantry combat vehicles. This formidable force was supported by a vast array of artillery weapons including FROG ground-to-ground rockets capable of striking Israeli population centres. Helicopter-borne commandos were poised to land deep behind Israeli lines to capture key crossroads and choke points in order to disrupt supplies or reinforcements from reaching the frontline units. Like the Egyptians along the Suez Canal, the Syrians now believed they had the answer to the fearsome Israeli Air Force in the shape of the innovative SA-6 'Gainful' anti-aircraft missile system combined with the highly mobile ZSU-23-4 Shilka self-propelled anti-aircraft gun. The plan was well conceived and had every chance of success given the complacency of the enemy. The scene was set for an armoured battle of epic proportions.

COUNTDOWN TO WAR

The Israeli forces on the Golan Plateau were part of the 36th Armoured Division under the command of Major General Rafael 'Raful' Eitan, with his headquarters at Nafakh. In the opening days of October, they remained wholly inadequate in face of the threat. On Friday 5 October, the IDF Chief of Staff Lieutenant General David Elazar ordered a Gimel alert that cancelled all leave and warned staff officers to prepare for the immediate mobilization of reservists. The personnel of the other two tank battalions of the 7th Armoured Brigade, the 71st and 83rd, were flown north and rapidly equipped with Shot Cal tanks before joining the 77th on the Golan Heights. The 7th Armoured Brigade was the most prestigious armoured formation in the IDF, having been formed during the War of Independence. The brigade was commanded by Colonel Avigdor 'Yanosh' Ben-Gal, a lanky 38-year-old who had risen through the ranks of the IAC. When his family was killed in the Holocaust, Ben-Gal arrived in Palestine in 1944 from Poland via Siberia, India, Teheran and Egypt: in his own words: 'I joined the army in 1955. The army was my home. I was born again. My second birth was in a tank'. Despite his unkempt appearance, he was a consummate professional soldier and a skilled proponent of armoured warfare. His battalion commanders were similarly highly experienced, with Lieutenant Colonel Meshulam Rattes as OC 71st Tank Battalion and Lieutenant Colonel Haim Barak, OC 82nd Tank Battalion. The brigade also included a Sayeret reconnaissance unit mostly mounted in Jeeps and Armoured Personnel Carriers (APC). In addition, the 75th Armored Infantry Battalion commanded by Lieutenant Colonel Yos Eldar was attached to the brigade with their M113 APCs and M3 half-tracks.

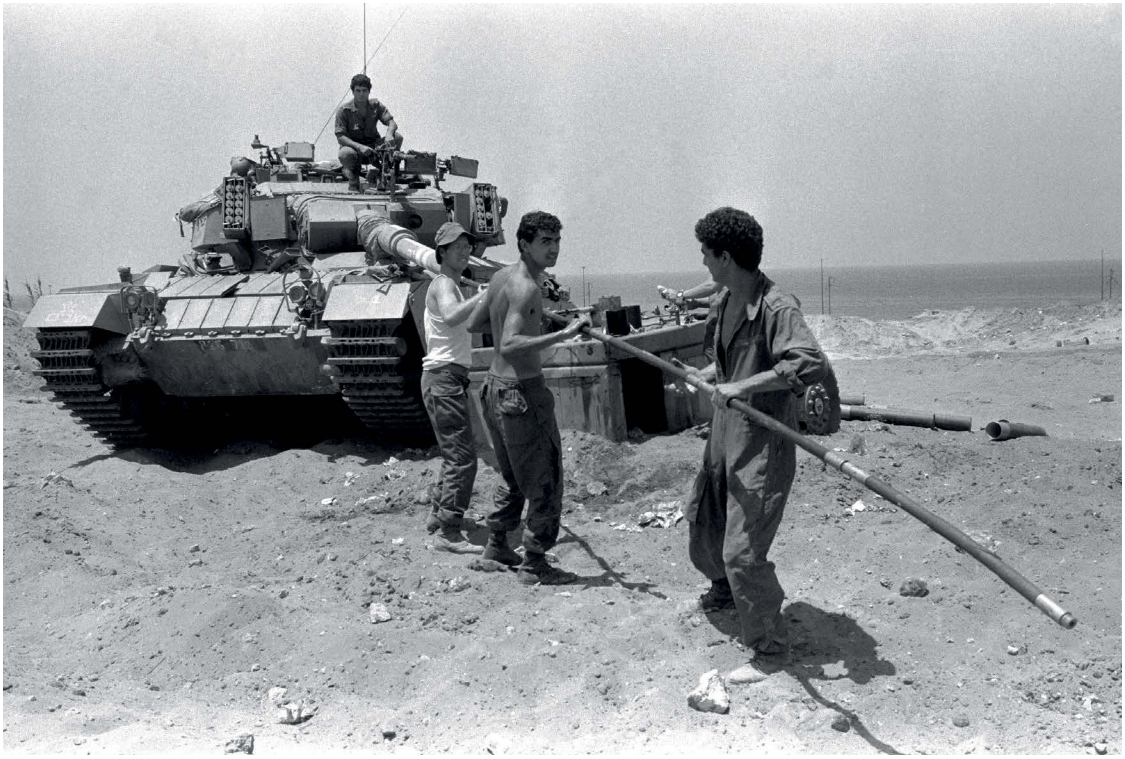
In time of war, the 7th Armoured Brigade was part of Southern Command and deputed to lead any counter-offensive across the Suez Canal. To this end, one of its tank companies of the 82nd was assigned the specialized role of towing bridging equipment across the desert to prepared crossing points on the banks of the Suez Canal. But even before Minister of Defense Moshe Dayan had ordered the 77th to the northern front, Colonel Ben-Gal had had a premonition of the prospect of war on the Golan Heights. On 23 September, he organized a familiarization tour of the Golan Heights for his brigade staff and battalion commanders. Their newfound knowledge of the difficult terrain was to be of inestimable value in the forthcoming battles. Days of frantic preparation followed as the other battalions of the 7th Armoured Brigade requisitioned tanks and equipment from the depots of Northern Command before deploying on to the Golan Heights. The Shot Cals were taken out of storage, tested and loaded with ammunition and equipment before the guns were zeroed. Meanwhile, company and platoon commanders were criss-crossing the Golan Heights to familiarize themselves further with the terrain. Throughout the night of Friday 5 October, tank transporters and supply trucks groaned up the escarpment to the Golan Heights, their supplies including large stocks of ammunition. Northern Command had authorized an extra 200 rounds per tank as well as more 155mm shells for the 11 batteries of M109 self-propelled howitzers: just 45 guns as against the 930 of the Syrians but it was the only M109 regiment in service. The 7th Armoured Brigade was directed to complete its deployment to its assembly positions on the Golan Heights by noon on 6 October 1973, the Day of Atonement or Yom Kippur. There were now 177 Shot Cals in place on the Golan Heights: the odds were down to 8:1.

Yom Kippur was the day chosen for the simultaneous offensive by Egypt and Syria against Israel. It is the holiest day in the Judaic calendar but the state of the tides in the Suez Canal and the amount of moonlight were more important to the Egyptians, while Syria wished to attack before the winter snows arrived. Egypt was determined to break the diplomatic logjam in order to reclaim the Sinai Peninsula while Syria sought to regain the Golan Heights by force of arms. The Arab armies fielded some 4,480 tanks and AFVs with 4,300 APCs while Israel possessed 2,000 tanks and 4,000 APCs. Almost all were committed to battle in the Sinai Peninsula and on the Golan Heights. The total number of AFVs was greater than those at the battle of Kursk and they fought in a smaller geographical area than the Kursk salient. With separate but simultaneous attacks from north and south, the parallels between the two offensives were remarkable. At 1345hrs, Israeli observers on Mount Hermon noticed the camouflage netting being removed from the hundreds of Syrian gun positions on the Damascus Plain. At 1356hrs, a thunderous artillery barrage fell upon the Israeli positions on the Golan Plateau that lasted 50 minutes without pause. Simultaneously, MiG-19 ground attack aircraft swooped down to bomb and strafe the headquarters at Nafakh. At that precise moment, Colonel Ben-Gal was giving his last-minute briefing to his battalion commanders and their company commanders at the base. He immediately gave a single, simple order: ‘Everyone to your tanks!’

LIGHTNING STRIKES

At that moment, Major Shmuel Askarov, the deputy commander of the 53rd Tank Battalion, was in his office at the Hushniya base of the 188th Barak Brigade. His Shot Cal was parked outside his door with the crew within hailing distance. As he had indicated to General Moshe Dayan ten days earlier, he was certain that war was imminent. Throughout the night, the command elements of the brigade had been in conference revising plans and preparations. The commander of the 188th Barak Brigade was the Turkish-born Colonel Yitzhak Ben-Shoham. The brigade was composed of just two battalions with the 74th Tank Battalion commanded by Lieutenant Colonel Yair Nafshi deployed in the north from the slopes of Mount Hermon to near Mutzva 109 to the south of Kuneitra and the 53rd Tank Battalion commanded by Lieutenant Colonel Oded Erez from Mutzva 109 southwards. There were just 69 Shot Cals scattered along some 43 miles of front bordering the Purple Line, giving an average of one and a half tanks per mile of front. Nevertheless, Ben-Shoham had received no indication from Generals Hofi or Eitan that the Syrians were likely to launch anything besides another 'battle day'. The radio net of the brigade was designated 'Toffee' and it immediately despatched the codeword – 'Capital'. It was the signal for the tanks of the brigade to move to their assigned positions on the firing ramps beside the various Mutzavim. Major Askarov was in his tank within moments and heading eastwards at high speed through the heavy artillery barrage to Mutzav 111 overlooking the Kudne Gap. As his Shot Cal mounted the firing ramp he could see nothing but churning clouds of dust due to the intensive shelling. Eventually, there was a lull and the dust settled momentarily. He was dumbfounded when he saw hundreds of Syrian T-54 and T-55 tanks emerging from the dust cloud in dense columns spearheaded by specialized bridge-laying and mine-clearing variants.

All along the Purple Line, the tank platoons of the Barak Brigade were under fire as they manoeuvred into their pre-assigned firing positions. In the northern sector, the 74th Tank Battalion was deployed with Company Het under the command of Captain Eyal Shaham with its three platoons guarding Mutzavim 104, 105 and 107 with the company commander and two tanks at Mas'adeh. Company Alef under the command of Major Zvi Rak was stationed in and around Kuneitra as it was thought to be a Syrian priority objective for a 'battle day'. Company Bet under the command of Major Avner Landau was held in reserve at Wasset Junction, while the battalion commander Lieutenant Colonel Nafshi stationed himself on the commanding heights of Booster Ridge overlooking the Kuneitra Gap. At 1415hrs, an observation



The crew of a Shot Cal Gimel of 71st 'Reshef' Battalion 188th 'Barak' Armoured Brigade clean their tank's weapons during operations in Southern Lebanon. The Shot Cal Gimel was introduced into service in June 1980. Later models of Shot Cal incorporated the same fire control system as the Magach 6B Gal.

post on Hermonit reported the advance of an armoured force of T-54/55s preceded by bridging and mine-clearing tanks but Nafshi immediately implemented a coordinated fire plan of tanks and artillery that stopped the enemy before they reached the anti-tank ditch. But the pressure was mounting by the minute. The Syrian 68th Infantry Brigade with an attached tank battalion of T-54/55s launched an assault between Mutzavim 104 and 105 but Nafshi promptly despatched Company Bet to the threatened area and caught the enemy in the flank as the MTU-20s were trying to deploy their bridges over the anti-tank ditch. A further attack by the Syrian 85th Infantry Brigade to the north and south of Mutzav 107 was similarly halted by the 74th as was an attack by the Syrian 52nd Infantry Brigade to the north of Mutzav 109. The Shot Cals on the firing ramps were exacting a fearful toll of the swarming enemy T-54s and T-55s while the few mobile reserves moved from one threatened point of penetration to another. The general feeling at the outset was that this was just another 'battle day' but now the frontline units were reporting that yet more tanks were approaching. Equally serious was that the Shot Cals were running short of ammunition. Even now they were obliged to retire so that the crews could access the rounds hidden in the bowels of the tanks.

South of Mutzav 109, the 53rd Tank Battalion was under even more intense pressure as the 5th and 9th Infantry Divisions mounted the main Syrian attacks through the Kudne and Rafid Gaps. Company Zayin under the command of Captain Uri Avika was deployed from Mutzav 110 to 114, together with Major Askarov, covering the Kudne line. Immediately to their south was Company Gimmel under the command of Captain Uzi Arieli, although three tanks of his tanks were detached to protect brigade HQ. The company's task was to guard the Tapline Road with a platoon of tanks at Juhader close to Mutzavim 114 and 115. The Trans Arabian Pipeline or Tapline extended some 1,200 miles from Arabia to the Mediterranean coast in Lebanon and ran diagonally across the Golan. It was to prove crucial in the campaign. As soon as the attack began, reports came in of a Syrian probe along the road bordering the Tapline and Captain Arieli despatched a platoon as reinforcements commanded by Lieutenant Oded Beckman. On arrival at Mutzav 115, his defending force numbered just five Shot Cals. To his front was a Syrian tank battalion of 41 T-54/55s of the 112nd Infantry Brigade giving a ratio of 1:8. Although his limbs seemed to be shaking uncontrollably, Beckman's mind was crystal clear. He noticed an MTU-20 bridgelayer at the head of the column and allowed it to lay its bridge across the anti-tank ditch and withdraw. Only when a T-54 gun tank manoeuvred on to the bridge did he open fire when it was halfway across. He destroyed a second T-54 as it tried to push aside the first one, effectively blocking the crossing site entirely. He then engaged a second MTU-20 before it reached the anti-tank ditch, stalling the whole Syrian attack. All along the Purple Line, the specialized T-54/55 variants of the MTU-20 bridgelayer and the mineclearing PT-54s fitted with mine-rollers were the priority targets to Israeli gunners since their primary role was to breach the anti-tank ditch and the minefields. Standard operating procedure dictated that these vehicles were engaged at the maximum effective range of 2,500m.

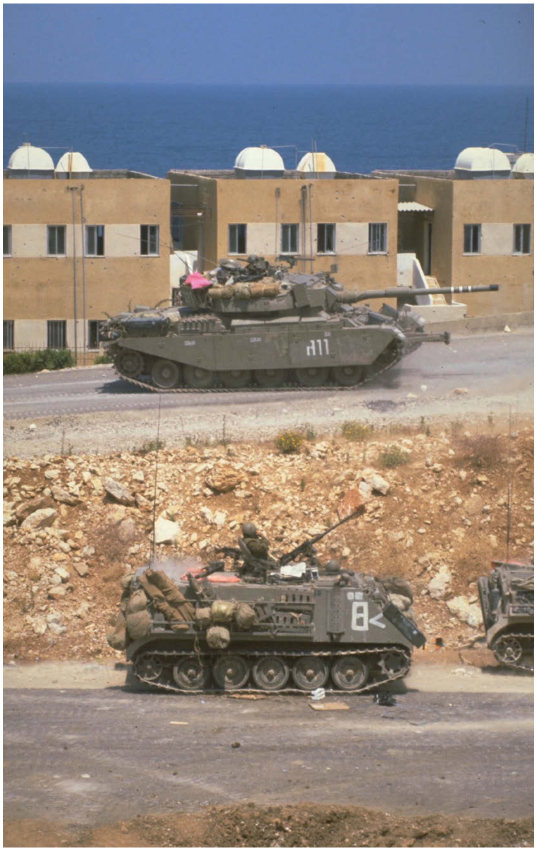
Finally, there was Company Vav under the command of Captain Avi Ronis with five tanks near Tel Juhader, a platoon at Mutzav 114 and a platoon under the command of Lieutenant Yoav Yakir at Mutzav 116, the most southern post on the Purple Line. Its role was to block both the Tapline Road and the South Road to El Al. In the more open rolling terrain of the southern Golan Plateau, this was an impossible task for so few tanks.

THE STAND OF THE BARAK BRIGADE

At the command headquarters at Nafakh, confusion reigned since many of the senior officers were absent including General Khaka Hofi, his deputy, chief of staff and the commander of the resident 36th Armored Division, Major General Raful Eitan. At noon, Hofi had flown to Tel Aviv in his Piper Cub leaving Colonel Ben-Shoham in command of the Golan: a fact he failed to convey to Colonel Ben-Gal. Accordingly, the latter baulked at being given orders by his equivalent in rank to move two of his battalions to the Wasset Junction. He returned to Nafakh to clarify the situation only to find the command bunker jammed packed with personnel sheltering from the artillery bombardment. Finding it impossible to talk to Ben-Shoham, he informed the Northern Command operations officer, Lieutenant Colonel Uri Simhoni, that he was going to move the 7th Armored Brigade towards Kuneitra. Ben-Shoham himself was frantically busy communicating with his two battalion commanders as they fought their desperate battles along the Purple Line. Realizing the problem in the chain of command, Shimoni took it upon himself to assume the authority of the GOC Northern Command. Thus, a mere lieutenant colonel assumed command in the opening hours of Israel's most critical battle. Crucially, both the full colonels, Ben-Gal and Ben-Shoham, were willing to take orders from a subordinate in rank as the representative of Northern Command.

Shimoni's first decision was to have far-reaching consequences and effectively set the course of the battle for the next four days. Within the first hour of battle being joined, he ordered Ben-Gal to move two of his battalions to the sector north of Kuneitra and one to the southern Golan. The tanks moved out of their assembly points around Nafakh and headed eastwards along the various tracks and roadways but still carefully trying to avoid running over the irrigation pipes of the Golan kibbutz farmers. Under withering artillery fire, the 7th Armored Brigade deployed along the high ground some two and a half miles from the Purple Line, acting as an immediate reserve to the Barak Brigade now heavily engaged along the whole of the 43-mile frontlines, giving an average of just one and a half tanks per mile of front. This meant there were to be three tank battalions north of Kuneitra and two to the south. His decision was based on the information he was receiving from the front. The 53rd Tank Battalion's initial reports indicated that they were containing the Syrian attacks in the southern sector. But in the north the observation posts on lofty Mount Herman and the tall tels were able to see the magnitude of the overall offensive from their elevated positions, a facility denied to the 53rd. It also reinforced the mindset of Northern Command that was convinced that the Syrians would attack through the Kuneitra Gap following repeated wargames by the Israelis. Critically at this juncture, there were no more reserves to be had as the general mobilization of the IDF had only just been set in motion. Yet, with no intelligence to the contrary, Colonel Ben-Shoham was still convinced that this was just another 'battle day' whereas Ben-Gal realized this was general warfare on two fronts. By mid-afternoon, Ben-Gal decided to visit the frontlines to see for himself and organize his brigade accordingly while Ben-Shoham remained in the command bunker at Nafakh and directed his brigade by radio.

At Mutzav 111, the deputy commander of the Barak Brigade was perched on a firing ramp in his Shot Cal opposite the Syrian fortification on Tel Kudne. To his front, the ground was still shrouded in dust and smoke as the Syrian artillery bombardment continued unabated. When the barrage lifted, Major Shmuel Askarov saw scores of tanks pressing forward in columns four abreast astride the Kudne Road



as the 33rd Infantry Brigade launched its assault. Five MTU-20 bridgelayers were in the van. In his crew, Askarov had the finest gunner in the brigade, Yitzhak Hemo. Within minutes, three of the bridgelayers were in flames but Askarov suddenly realized that he was fighting alone. His accompanying tanks were sheltering behind the ramps from the fearsome artillery fire. Askarov immediately called up his fellow tank commanders by radio but got little response. Ordering his driver to reverse, he drew up beside the closest Shot Cal and jumped across. Drawing his pistol he pointed it at the commander's head and ordered 'Get up there or I shoot', indicating the firing ramps. The other tanks quickly mounted the ramps and began firing methodically up and down the long lines of T-54/55s, but still they kept advancing. With a display of cold courage not seen before by the Israelis, the Syrian tanks simply bypassed the burning victims of the devastating Israeli fire and pressed on, pausing occasionally to return fire.

Where the terrain permitted, groups detached themselves from the advancing columns and engaged the Shot Cals on the ramps with volley after volley of armour-piercing shot, despite the difficulty of hitting such small targets. Inevitably, rounds struck home and one by one the tanks on the ramps were hit and most of their commanders killed, since the Israeli commanders fought with the heads outside of the cupolas for better vision. Askarov's Shot Cal was hit four times but remained operational. Within the first two hours, his crew destroyed 35 T-54/55s and numerous APCs, thanks to the superb gunnery of Yitzhak Hemo, who achieved a remarkable hit rate of one enemy AFV for every one and half rounds fired. Each Shot Cal carried 72 rounds. But still the Syrians advanced and closed on the ramps. Soon after 1600hrs, Hemo hit a tank to the left of his ramp at a range of just 50 yards but by now there were others even closer. Akarov swung the turret to the right to allow Hemo to engage another T-54 at 30 yards range but the two tanks fired simultaneously. Askarov was blown out of his commander's cupola with serious wounds to the throat and head. As dusk fell, the Kudne Road was now open.

Tanks and M113 APCs work in conjunction during an operation in Lebanon. The Shot Cal Gimel is equipped with a front mounted push bar to clear obstacles and shove disabled vehicles aside. The Shot Cal Gimel features prominent exhaust gas deflectors on the transmission covers.

To the north of Kuneitra, the fighting was bitter and intense around Mutzav 107 as the Syrian 52nd Infantry Brigade attacked in force with scores of tanks along the Damascus Road. Facing them were just the three Shot Cals of Lieutenant Shmuel Yakhin's platoon of Company Alef, 74th Tank Battalion. The three tanks were perched on the firing ramps several hundred yards apart on each side of the strongpoint that was manned by men of the 1st Golani Infantry Brigade. They opened fire at 2,000 yards' range inflicting numerous casualties among the enemy. Volley after volley of APDS rounds crashed into the advancing AFVs until the ammunition ran low. The company commander, Major Zvi Rak, arrived with seven tanks to add their firepower to Yakhin's platoon. Burning wrecks and exploding vehicles now dotted the landscape until the column veered to the south and out of range. Major Rak sent his deputy, Captain Oded Yisraeli, with a platoon of tanks in pursuit. He soon discovered a company of T-54/55s crossing the anti-tank ditch over a bridge laid by an MTU-20. The enemy were lined up like ducks at a fairground and all the tanks were destroyed within minutes. A mile further on, Yisraeli encountered another company attempting to cross but the Syrian tanks returned fire with determination. Syrian combat engineers had found the answer to the anti-tank ditch and were now filling it in with an unarmoured Caterpillar bulldozer. Captain Yisraeli called his company commander for reinforcements. Leaving Yakhin's platoon at Mutzav 107, Major Rak and his four tanks moved southwards in support but he suddenly heard an explosion and found himself covered in blood. It took some moments before he realized it was not his own but that of his loader, who had been decapitated by an RPG. His headless torso slumped down into the turret spurting arterial blood around the interior. Both the gunner and driver became hysterical at the sight of their comrade's body. Rak slapped them and doused them in water until they calmed down. He then returned to Kuneitra to extricate the body and change to another Shot Cal. Such deaths occurred regularly during the first few days of the campaign. Although it was a relatively simple matter for Ordnance Corps personnel to clean the interior of the turret of blood, it did not take long it for the residue to become malodorous, much to the discomfort of subsequent crews. The answer was found by wiping the interior walls of the turret with diesel oil as its smell masked the stench of the blood or decaying flesh. Furthermore, so many tank crewmen, especially tank commanders, were being decapitated that crews were ordered to wear their dog tags around their ankles since they were often lost from a headless body.

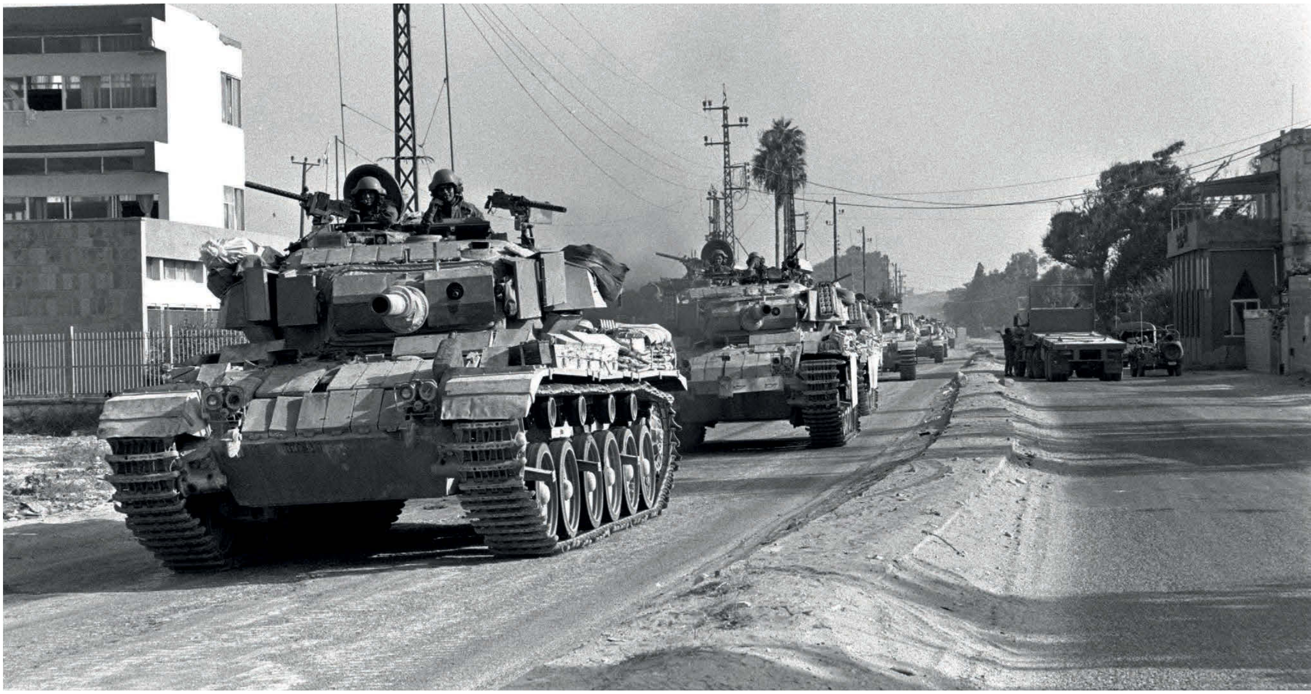
Far to the south, a platoon of Company Vav under the command of Lieutenant Yoav Yakir had been fighting a lone action all afternoon. Although assigned to support the southernmost strongpoint of Mutzav 116, he had fought an action near Tel Saki against a force of some 25 T-54/55s trying to cross the Purple Line along an old Roman road that once led to Damascus. Together with his first sergeant Nir Atir, Yakir destroyed most of them by accurate, long-range tank fire. Around 1600hrs, the Syrian 47th Tank Brigade attached to the 5th Infantry Division was observed advancing on the anti-tank ditch opposite Mutzav 116. The strongpoint's commander, 2nd Lieutenant Yossi Gur of the 50th Parachute Battalion, immediately radioed to Lieutenant Yakir for support as his position was being blanketed in artillery fire. Yakir's platoon hurried north to Mutzav 116 where the Syrians had deployed bridges across the anti-tank ditch and tanks were streaming across. The three Shot Cals engaged the 60 T-55s of the 47th Tank Brigade from open terrain at ranges from 200 to 1,000 yards. They were joined by two tanks from a neighbouring platoon but these were soon knocked out: the gallant platoon was once more fighting alone. As darkness fell, they fought on by the light of flares fired from Mutzav 116 until 2300hrs by when two of Yakir's tanks had fired all their ammunition and the other had just five rounds left. Lieutenant Yakhir sought permission to withdraw and be resupplied with ammunition but the situation was so desperate that he was ordered to continue the action with just machine-gun fire to try and dissuade the Syrians from advancing in the dark. A few minutes later, Yakir was killed and Sergeant Nir Atir assumed command of the platoon. Realizing the hopelessness of the situation, Colonel Ben-Shoham ordered Atir to withdraw for more ammunition. The platoon had been fighting for seven hours without respite but, just as it fell back, the very first reinforcements were finally arriving on the Golan Heights, albeit just ten tanks of a ready reaction battalion. The Barak Brigade and its 69 Shot Cals had destroyed scores of Syrian T-54/55s and numerous other AFVs but the battle was to continue long into the night.

7TH BRIGADE ENTERS THE FRAY

Major General Khaka Hofi arrived at the Nafakh headquarters at 1630hrs in company with Major General Mordechai 'Motti' Hod, the former head of the Israeli Air Force and the architect of the pre-emptive strike in the Six Day War of 1967: a stratagem denied to the IDF in October 1973 by the government. He immediately concurred with Colonel Shimoni's disposition of forces but he divided the front into two separate commands. The 7th Armored Brigade was to assume responsibility for the northern sector and absorb the remnants of the 74th Tank Battalion into its command. The southern sector was now the responsibility of the 188th Barak Brigade, comprising its own 53rd Tank Battalion and the 82nd Tank Battalion, transferred in from the 7th Armored Brigade. The latter was now deployed along the high ground some two miles behind the frontlines with the 71st Tank Battalion in the north, and the 77th Tank Battalion in the centre covering the Kuneitra Gap from the hill feature of Booster down to the deserted town of Kuneitra itself. Between them was the 75th Armored Infantry Battalion, reinforced by Company Humous under Lieutenant Emi Palant from the 77th Tank Battalion. The 82nd Tank Battalion had moved south to support the 188th Armored Brigade and was now positioned in reserve but unfortunately Lieutenant Colonel Oded Erez had not been informed of their presence. During the afternoon's fighting, the 53rd had lost 12 tanks, a third of its total. Two company commanders had been killed and the battalion deputy commander, Major Shmuel Askarov, wounded. He was now in hospital at Safed. Following an operation on his throat and for his other injuries, he was told he must remain in hospital for at least two weeks to recover. The 74th in the north had lost seven of its 33 tanks but had contained every Syrian attack so far. The crews were exhausted by their exertions and the fearful concussion of exploding artillery shells. Although the crews were relatively immune inside their tanks to artillery fire, the red-hot fragments sheared off radio antennae, damaged optical sights and ignited camouflage nets or bedding on the exteriors rendering the vehicles deaf and blind until repairs could be made. Such artillery fire was also deadly to crew commanders standing with their head and shoulders exposed in their cupolas for better vision of the battlefield.

Around 1700hrs as dusk fell, the Syrians resumed the offensive with major attacks by a further two brigades in the northern sector and three more in the south against the hard-pressed Barak Brigade. Thanks to the intelligence gained during previous 'battle days', the Syrians knew the dispositions of all the Mutzavim and the firing ramps. In the failing light, tanks and infantry infiltrated through the gaps in the Israeli defences in large numbers. Infantry tank-hunter teams now moved among the frontline positions. T-54s and T-55s were pouring through the Israeli lines in the southern sector with approximately 140 in the Kudne area, some 60 advancing along the Tapline Road towards Hushniya and another 150 breaking through around Mutzavim 115 and 116. The 53rd Tank Battalion had just 15 tanks left fighting these hordes of T-54/55s along the Purple Line. The Syrians were now exerting intense pressure along the entire Israeli defence line from Mount Hermon to Tel Saki.

The 53rd was desperately low on ammunition but it was virtually impossible to withdraw and reload since the Syrians would have quickly overrun the firing ramps. Lieutenant Colonel Erez radioed for more supplies to be brought forward. At 1830hrs, Colonel Ben-Shoham decided to leave Nafakh and join his brigade. In his M3 half-track command vehicle, he took with him his operations officer, Major Benny Katzin, while his deputy Lieutenant Colonel David Yisraeli remained at Nafakh. But as they neared Hushniya they came under such intense artillery fire that



A column of Shot Cal Gimel tanks redeploy to the Israeli Security Zone in Southern Lebanon at the conclusion of Operation Peace for Galilee in late 1982. A further lesson of the October War of 1973 was the need for a second external machine gun mounted at the loader's position for use against infantry equipped with RPGs and Sagger ATGWs.

Ben-Shoham radioed for his Shot Cal be brought to him. When it arrived, the crew informed him that they had passed many tanks in the darkness. Since the Barak Brigade was fighting along the Purple Line some four miles further east, the realization began to dawn on Ben-Shoham that the Syrians must have broken through in force. Belatedly, the 82nd Tank Battalion of Lieutenant Colonel Haim Barak was ordered forward to support the remnants of the Barak Brigade. The 82nd was composed of three companies of which two were made up of recent conscripts only halfway through their basic armour training course. On the other hand, Company Alef commanded by Captain Eli Geva was a veteran unit and considered among the best in the IAC. Company Bet under the command of Captain Yaacov Chessner was despatched to the Kudne sector at Mutzav 111 where it arrived with seven tanks having lost four en route. Company Gimel was sent to support Mutzav 116 but was ambushed on the way, losing seven tanks in its first action. Captain Geva and Company Alef fought a successful battle in the darkness along the patrol road running north–south behind the Purple Line, destroying some 30 tanks for the loss of just one.

The Syrians exploited their success in the south by committing the 1st Armoured Division through the Rafid opening following the successful attack of the 46th Tank Brigade while the 15th Mechanized Brigade of the 3rd Armoured Division expanded the breach in the Israeli line at Kudne. A strong column of AFVs from this formation turned north towards Kuneitra with the intention of striking the southern flank of the 7th Armored Brigade and dislodging it from its dominating fire positions.

All the Syrian tanks from the T-54 to the T-62 of the Syrian armoured divisions were fitted with infrared headlights and projectors to aid night driving and illuminate targets at night with beams of light that were invisible to the human eye without special viewing devices. It gave the Syrians a distinct tactical advantage over the Israelis since their tanks had no such equipment. In the past, night-fighting had been an IDF speciality and they did not believe that the Arabs would continue operations under the cover of darkness. For the same reason, the IDF had too few artillery illuminating rounds and flares as previously the Syrian 'battle days' had invariably ended by nightfall. The failure to equip Israeli forces adequately for night-fighting was to prove costly in the coming hours. Aided by their infrared equipment, Syrian tanks were now infiltrating up the wadis and tracks between the Israeli positions in the northern sector where the Shot Cals of the 74th Tank Battalion had broken the Syrian tanks. Under the cover of darkness, Syrian combat engineers were filling and levelling the anti-tank ditch with bulldozers in numerous places.

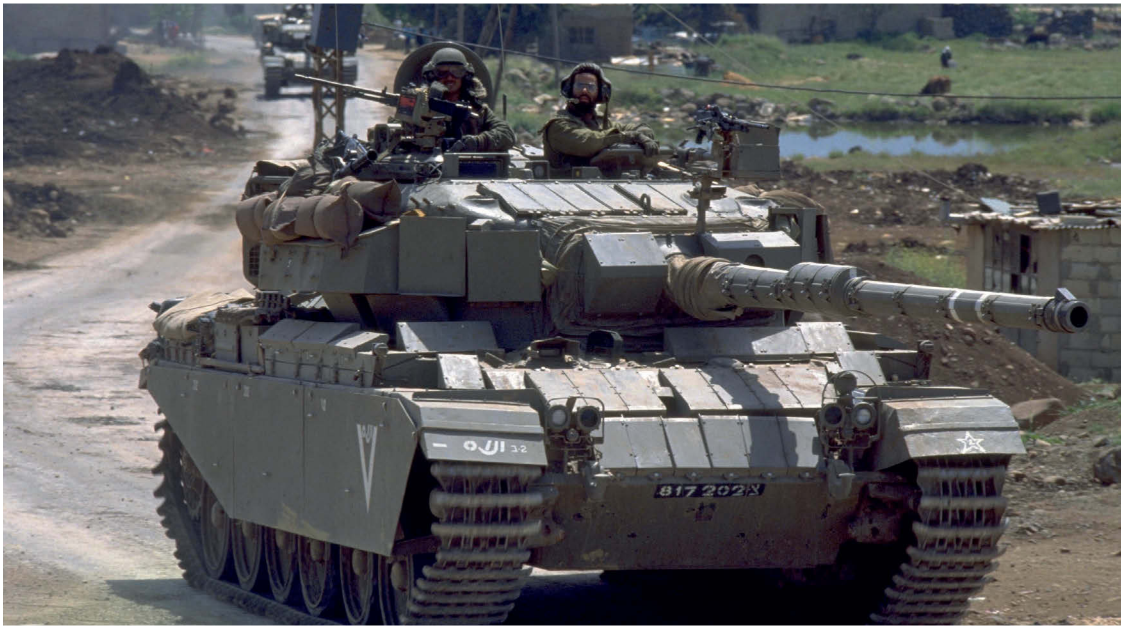
Soon after 2100hrs, the renewed Syrian offensive struck the 7th Armored Brigade in the centre at the Hermonit hill feature that was defended by the 75th Armored Infantry Battalion. With clattering tracks and belching diesel exhaust fumes, the Syrian tanks were almost invisible in the dark. The battalion commander Lieutenant Colonel Yos Eldar called for flares to illuminate the battlefield but demands along the front quickly exhausted supplies. It was another glaring tactical and logistical failure by the IDF because they had believed the Syrians usually ended their 'battle days' before nightfall, so flares were deemed unnecessary in large quantities. The Israeli tank crews were now fighting blind. Only some of the tank commanders had special binoculars capable of detecting infrared radiation. On Booster Hill to the south, Lieutenant Colonel Avigdor Kahalani witnessed the Syrian assault and quickly mounted a counterattack. As his tanks approached Hermonit, he heard over the radio that Yos Eldar had been wounded and evacuated so he took command of the battle. It was the first major Syrian incursion across the Purple Line of the day on the 7th Armored Brigade front. With no parachute flares to guide them, the Israeli gunners engaged targets by the light of burning hulks in the valley below. The battle raged for three hours as the Syrian 7th Infantry Division tried repeatedly to overwhelm the 7th Armored Brigade. At one point, Kahalani put his IR-sensitive binoculars to his eyes only to see his own tank bathed in light but when he lowered them he could see nothing. Realizing his tank was being targeted by a T-55 just a few dozen yards away, he ordered his driver, Yuval Ben-Ner, to reverse down the slope immediately. The fighting died down after midnight and the exhausted crews took turns sleeping fitfully not knowing what the morning held.

During the day of Yom Kippur, the Syrians had committed some 720 tanks to battle and despite heavy losses had broken through the Israeli defences in the southern Golan, although their timetable was now frustrated and delayed by the gallant defence of the 188th Barak Brigade. Over 300 tanks were now advancing into the heart of the Golan Plateau. The 132nd Mechanized Brigade was heading southwestwards towards the religious settlement of Ramat Magshimim. The 43rd Tank Brigade began a two-pronged attack with the major thrust towards Nafakh while a secondary force turned northwards up the Reshet Road towards Kuneitra. The last remnants of the Barak Brigade under the command of Lieutenant Colonel Oded Erez were still fighting rearguard actions against appalling odds. Gradually they were forced backwards and the survivors, including three from the 82nd Tank Battalion and three from the 53rd of Sergeant Atir's platoon that had run out of ammunition, withdrew to the relative safety of Tel Faris where they formed a night leaguer with some paratroopers, support troops and dismounted tank crews. During the night more stragglers arrived but the position was now completely cut off by the Syrians. Worse still, the 51st Tank Brigade with some 100 T-54/55 was now advancing along the Tapline Road towards the Israeli command headquarters at Nafakh and there was not a single Israeli tank in their path. Disaster loomed but was to be averted by the indomitable courage of a solitary lieutenant, Zvi 'Zvika' Greengold. This 21-year-old lieutenant fought for 20 straight hours, changing tanks six times as they were shot out from under him, and is credited with an astonishing 40 enemy tanks, although he himself would claim only 20.

At 0300hrs on 7 October, the column of tanks and AFVs of the 43rd Tank Brigade was spotted moving northwards towards Kuneitra by the tank commander of a disabled Shot Cal. He reported his sighting to Colonel Ben-Gal. The role of the 43rd Tank Brigade was to strike the southern flank of the 7th Armored Brigade and dislodge it from its dominating fire positions. If this attack succeeded, the Israeli defence of the northern Golan would be shattered just as it had been in the south. Ben-Gal immediately ordered his Tiger Company under Captain Meir Zamir to meet the threat. Zamir carefully selected an ambush site with his ten tanks on both sides of the Reshet Road but positioned well back in hulldown positions. Since the Israelis did not possess any night sights on their tanks, they turned off their engines and waited in silence. Soon they heard the rumble of the approaching armoured column. When most of the tanks were in the killing zone, one Shot Cal switched on its searchlight to illuminate the area. Within short order, some 40 T-54/55s were destroyed and the advance northwards halted. While some of the survivors retreated, others turned westwards taking the line of least resistance towards the IDF headquarters at Nafakh.

Around midnight, the full gravity of the situation on the Golan Heights finally began to impinge on the senior officers of Northern Command at Nafakh. Against a background of artillery fire, Generals Hofi and Hod decided to return to the Northern Command headquarters at Safed beyond the Bnot Ya'akov Bridge at 0100hrs, after passing command of the Golan to Brigadier General Raful Eitan. Hofi called up IDF Chief of Staff David Elazar and expressed doubts that the Golan Heights could be held but ended by saying that only the Israeli Air Force could stop the Syrians. And for that daylight was necessary. But the air force was committed to a major operation at daybreak against the Egyptian missile screen along the Suez Canal under the codename 'Tagar' that had been in preparation since the War of Attrition. Tagar was cancelled and the air force was ordered north as the present threat to Israel was realized to be measurably greater.

After losing several of their aircraft in the opening hours of the war, the A-4 Skyhawk squadron at Ramat David airbase was now called upon to stem the Syrian armour on the southern Golan. But Syrian SAM-6 missiles quickly found their mark. The ground troops vowed not to call for any further air support. In the first two days of the war, the Israeli Air Force lost 35 aircraft and close air support missions were largely suspended. Despite flying around 500 sorties a day over the Golan, the air force was committed to degrading the Syrian anti-aircraft defences as the priority mission. The reality was the tank platoons and companies were on their own without air support and with only limited artillery assets to stem the Syrian offensive. The deciding factor remained the tank crews themselves and the 105mm guns of their Shot Cals. As one platoon commander later recalled: 'It became clear in the first hour that the battle had been left to the company and platoon commanders and individual tank commanders. The adrenalin rush was tremendous. Orders from some officer in the rear didn't matter much. We were alone and we made the decisions.' No more so was this true than in the epic stand of the 7th Armored Brigade.



A Shot Cal Dalat of the Barak Brigade withdraws from the Security Zone in Southern Lebanon in March 1985. Note the mirror housing of the Muzzle Reference System on the end of the barrel and the additional .50-inch M2HB Browning above the mantlet. The markings indicate the second tank of the second platoon of the first company of the second battalion of 188th Armoured Brigade with the vehicle name VENUS on the front trackguard and inside the white chevron.

IN FIRE THEY WILL COME

At 0400hrs, Lieutenant Colonel Avigdor Kahalani of the 77th Tank Battalion woke in the light of a chilly dawn. Using the callsign 'Shoter' or 'Policeman', he contacted his company commanders and ordered their crews to start their engines. The Shot Cals burst into life and black exhaust smoke filled the air. Some 2km to their front scores of T-54/55s were doing the same. It reminded Khahalani of the roar of lions ready to pounce on their prey. He ordered the battalion forward on to the firing ramps overlooking the valley between Hermonit and Booster – the fabled Kuneitra Gap. As the Shot Cals took up their hulldown positions, the Syrians began to advance in serried ranks with all the crew hatches closed. All along the line, the Shot Cals engaged the enemy out to ranges of 1,500m; each crew fighting their own private war for survival. Numerous Syrian tanks were hit but the 77th was taking casualties as well. The commander of Vespa Company, Lieutenant Yair Swet, was killed as were seven other tank commanders, mostly from artillery fire as they stood exposed in their cupolas. One Shot Cal was deputed to evacuate the wounded to the medical teams that had moved as close to the front as they could in their vulnerable M3 half-tracks. Similarly, the Ordnance Corps Forward Repair Teams were working non-stop to repair any battle-damaged tanks and return them to the fighting troops. But they were inhibited by a lack of armoured recovery vehicles and their half-tracks were not powerful enough to tow the victims, so combat engineers on unarmoured bulldozers answered the call despite the devastating enemy artillery bombardment. With grim determination, attack followed attack at 0800hrs; at 0900hrs and again at 1300hrs. Khahalani marvelled at the courage of the Syrians; unseen in previous wars and so all the more unexpected.

The same was not the case in the southern Golan where the 53rd Tank Battalion had just 12 tanks left clustered in a defensive position at Tel Faris. During the night, Colonel Ben-Shoham had been forced back westwards by the relentless Syrian advance. His last order to Oded Erez had been to retire to Tel Faris with the words: 'All we can do now is hang on until the reserves come up. We've done our bit.' At dawn, the first Syrian tanks arrived at Ramat Magshimim. From there, they drove on unopposed towards El Al and halted some 700 yards short. At Mutzav 111, the radio operator intercepted a transmission from the Syrian unit: 'I see the whole Galilee in front of me. Request permission to proceed.' But the request was denied. The opportunity of victory was slipping away as even now the first 25 tanks of Colonel Ran Sarig's 17th Reserve Armored Brigade were crossing the Arik Bridge and climbing the Golan escarpment. The Israeli mobilization was ahead of schedule. In contrast, the Syrian timetable was falling behind due to the tenacious defence of the Shot Cals. The whole weight of the Syrian offensive was still directed towards Nafakh despite the gallant defence of 'Force Zvika' along the Tapline Road through the night. Col. Ben-Shoman's command team now joined 'Force Zvika'. However, the T-62s of the Syrian 1st Armoured Division were advancing along Yehudia Road threatening to outflank 'Force Zvika' fighting the 51st Tank Brigade on the Tapline Road. On learning of this new threat to his headquarters, Brigadier General Eitan ordered Ben-Shoham to return immediately to Nafakh. With the sun now high in the sky, Ben-Shoham turned his Shot Cal towards Nafakh, standing upright in the trurret together with Benny Katzin. As they passed a disabled T-54, they were killed outright by a burst of machine-gun fire. Ben-Shoham's deputy, Lieutenant Colonel David Yisraeli, was also dead, killed in action just moments before. The redoubtable 188th Barak Armoured Brigade now ceased to exist.

But its sacrifice had not been in vain as the Centurion tanks of the 679th Reserve Armoured Brigade under the command of Colonel Ori Orr was now reaching Nafakh from the west. By nightfall, the attack on Nafakh had been contained but the 1st Armoured Division was still moving inexorably westwards towards the Bnot Ya'ackov Bridge, which was even now being readied for demolition as the Israeli defence line in the central Golan was still far too thin. Accordingly, Northern Command dictated that all reinforcements be directed to the central and southern Golan. Originally, the 679th Reserve Armored Brigade was sent to support the 7th Armoured Brigade but was diverted to Nafakh. The 7th Armoured Brigade was on its own. After the battle with the Syrian 78th Tank Brigade throughout the morning of Sunday 7 October, the 7th Armoured Brigade had destroyed 71 enemy tanks but the Syrians were now biding their time until darkness when they had the advantage of night-fighting equipment. However, the actual infrared equipment was rudimentary and only truly effective at ranges below 500 yards for engaging targets. Furthermore, the driver's IR periscope provided a flat two-dimensional monochromatic image that inhibited depth perception. On the Golan, this was a serious problem with its innumerable boulders and ditches. Many T-54/55s were immobilized on large rocks beneath their belly plates or shed tracks after slipping into unseen depressions. Unlike the Israelis, there was limited recovery or repair facilities for stranded AFVs so even those with minimal damage became booty for the IDF.

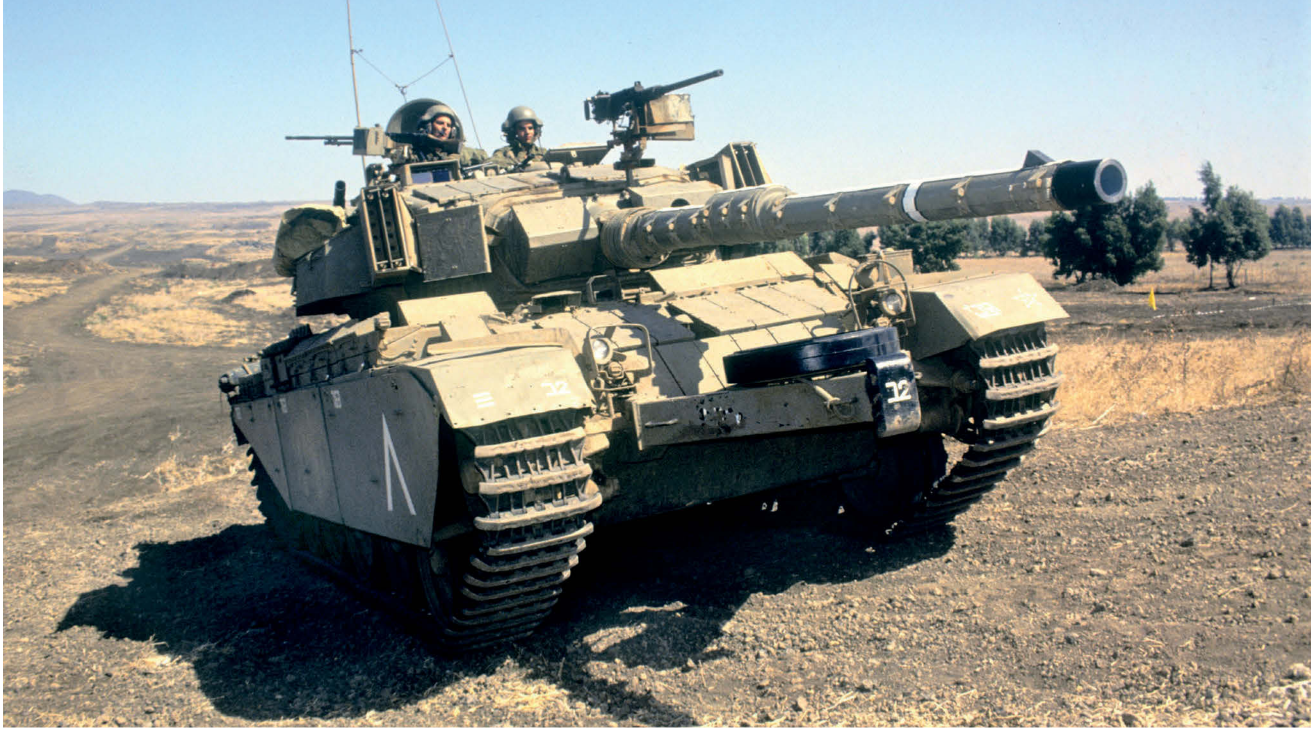
During the evening the Sayeret reconnaissance unit was conducting an intelligence-gathering mission in the valley facing the 7th Armoured Brigade under the cover of darkness when it encountered a large formation of Syrian armour in its forming-up position. The Sayeret beat a hasty retreat while informing Colonel Ben-Gal of their discovery. On their heels came the largest Syrian assault so far against the 7th Armored Brigade with a force of some 300 tanks. The battle raged until 0100hrs when the Syrians withdrew leaving scores of tanks burning or abandoned. There were now 130 knocked-out Syrian tanks and numerous other AFVs in front of the 7th Armoured Brigade's positions in what the Israeli crews called 'the Graveyard'; later it was to be known as the ‘Valley of Tears’. But this respite came at a cost. One by one the Shot Cals withdrew to refuel and rearm with ammunition. Medical teams moved forward to evacuate the dead and wounded from the tanks hit on the firing ramps closely followed by the forward repair teams to retrieve the damaged tanks and return them to service as quickly as possible.

On Monday 8 October, the third day of the war, the 77th Tank Battalion made a sweep through the Graveyard to harass the enemy and prevent them from recovering any AFVs or equipment. For the first time, they encountered a Sagger anti-tank guided missile (ATGM) as well as the usual heavy artillery, with one tank being hit by Sagger and another by an artillery shell that killed the commander, Sergeant Zelig Haberman. Thereafter, the Shot Cals returned to their firing ramps to wait for the next Syrian offensive. During the afternoon, the injured Lieutenant Colonel Yos Eldar arrived at the brigade against doctors’ orders. Both he and Shmuel Askarov had escaped from the hospital in Safed to return to their units. To Askarov’s horror the 188th Armored Brigade no longer existed but he immediately began collecting crews and tanks to raise the Barak from the ashes. Meanwhile, following the death of Colonel Ben-Shoham and his senior staff, the remnants of the 82nd Tank Battalion rejoined joined the 7th Armored Brigade. Similarly, Captain Chessner of Company Bet followed suit and together with their 17 tanks set off for the 7th Armoured Brigade logistic depot at Wasset Junction. Reinforcements were now pouring on to the Golan including the 146th Reserve Division of Brigadier General Moshe ‘Musa’ Peled and the 240th Reserve Division of Brigadier General Dan Laner. But, apart from the stragglers from the 82nd Tank Battalion, there were still no reinforcements for the 7th Armoured.

On the afternoon of 7 October, the Syrian high command held a fateful meeting at Katana some 25 miles behind the Purple Line. The decision was taken to halt the advance of all units on the southern Golan to allow them to reorganize and await reinforcements before a final offensive was launched on Tuesday. Only in the north was the offensive to continue with the 7th Infantry Division to attack that evening followed by the 3rd Armored Division as soon as they arrived at the front. Thus, the Syrians were reinforcing failure in the north rather than their success in the south. At dusk fell the tanks of the 7th Infantry Division formed up for yet another assault against the 7th Armoured Brigade. The GOC of the division, Brigadier Omar Abrash, was well forward with his troops readying his armour for the attack when an Israeli shell killed him. The attack was postponed until the following morning. It gave the 7th Armoured Brigade a welcome respite to repair many of their battle casualties and for the tank crews to rest before the next battle; Tuesday was to be the decisive day in the war on the Golan Heights since the Syrians were committing their elite units in a final bid for victory.

THE VALLEY OF TEARS

At dawn on 9 October, the Syrians attacked in great force. Once again, the assault was directed through the valley between Hermonit and Booster. The Shot Cals were already in hull-down positions on their firing ramps but under intense artillery fire. To the north between Hermonit and Bukata were the depleted ranks of the 71st Battalion under the command of Lieutenant Colonel Meshulam Rattes, with just seven serviceable tanks and to the south was the 77th near Booster with the remnants of the 74th and 82nd covering Kuneitra: a total of 34 tanks in all. As battle was joined and the enemy intentions became apparent, Colonel Ben-Gal ordered Khahalani to deploy his seven remaining tanks close to brigade headquarters at Yakir-



A Shot Cal Dalat of 53rd Battalion of 188th Armoured Brigade shows the final configuration of the Centurion gun tank in IDF service. The 53rd Battalion, together with the 74th, bore the brunt of the massive Syrian offensive of 6 October 1973 in arguably the greatest defensive battle in the annals of armoured warfare.

Kirton as a second line of defence. The Seventh was in a vice. To their front, the valley floor was now inundated with some 100 T-62s of the 81st Tank Brigade from the 3rd Armoured Division. The fighting was desperate on the central sector where the Shot Cals were being inexorably whittled away by artillery damage and hyper-velocity fin-stabilized tungsten bolts that ripped through armour plate with deadly effect. Such was the intensity of fire that Ben-Gal allowed the tanks to withdraw from the ramps to escape the worst of the shelling. The intention was that when the barrage lifted, the tanks would resume their positions on the ramps but the Syrians were advancing relentlessly within yards of the bombardment. Their tanks had every chance of getting there first. Yos Eldar and his vulnerable APCs were obliged to fall back further because of the massive artillery barrage.

Realizing the danger, Ben-Gall ordered Kahalani to advance towards the ramps. The fighting was now at close quarters and any tank hit at such ranges was sure to be destroyed, usually exploding in ball of flame. Survival was dependent on quick reactions and the ability of the crews to acquire targets, load the correct type of ammunition and fire with accuracy in the shortest possible time. Throughout the four days of battle, Israeli crews proved far more proficient in tank gunnery than their Syrian counterparts, often firing ten rounds a minute in the Shot Cal as against four in the T-54/55 or T-62. Kahalani and his crew alone succeeded in destroying five T-62s in five minutes. Yet still the Syrians advanced with great fortitude. From his position, Kahalani was able to see down into the valley where he could see hundreds of tanks massing. These tanks belonged to the elite Republican Guard commanded by Rifaat Assad, brother of the Syrian President Hafez Assad. Both sides realized that this was the last throw of the dice and victory or defeat was now at hand.

For the 7th Armoured Brigade, it was critical to regain these dominating firing ramps if the Syrians were to be stopped. The tank crews were emotionally drained and exhausted after almost four days of fighting, without proper sleep or food and under constant bombardment from artillery and air attack. The Shot Cals had survived numerous duels with T-54/55s but now in the final hours of the war, it seemed as if they would be overwhelmed by the hordes of T-62s. For the last four days, Colonel Ben-Gal had led his brigade with the surest touch, encouraging and cajoling his men calmly yet firmly, while always retaining a reserve of tanks, however small. These were fed into battle at critical moments and then another reserve was immediately formed from other assets in the brigade. In reality, companies or battalions no longer meant anything, as platoons moved here and there as the situation demanded, plugging into a different radio net as directed for however long before redeploying to another sector or unit. It was a measure of the professionalism and flexibility of the crews and their commanders. Coupled with the Herculean efforts of the forward repair teams, battle-damaged Shot Cals were quickly returned to service since the brigade was denied any reinforcements at all. Similarly, the wounded or dead were never left on the battlefield but were evacuated to the hard-pressed medical staff as soon as possible. All the while, logistic personnel drove their unprotected trucks through shot and shell to ensure a constant supply of fuel and ammunition. Ammunition was the key. The tanks had fired so many rounds that their gun barrels were shot out and were no longer accurate at long range, but the engagement distances were now measured in scores of yards at most.

Refused permission to withdraw, some reinforcements did arrive thanks to Major Shmuel Askarov who had discharged himself from hospital, together with Yos Eldar, on Monday morning. Once back on the Golan, he gathered tanks and men from a variety of shattered units. He was joined by Lieutenant Colonel Yossi Ben-Hanan, who had been the commander of the 53rd Tank Battalion until a month ago. The 53rd Tank Battalion of the Barak Brigade was born again. With the codename ‘Morning Exercise’, the patchwork force moved off to help the 7th Armoured Brigade in its desperate plight. In the meantime, the remaining tanks resisted attempts to position themselves on the ramps. One sergeant did offer to move forward but he was already out of ammunition. Realizing that direct orders were having no effect, Kahalani resorted to shaming his men into action:

‘Shoter stations. This is the battalion commander. Look at the courage of the enemy mounting the position in front of us. I don’t know what’s happening to us. They are only the enemy we have always known. We are stronger than them. Start moving forward and form a line with me. I am waving my flag. Move!’

Slowly the Shot Cals began to stir, gathering pace until a solid line was formed with just the heads of the tank commanders visible in the turrets. A T-62 loomed over the ramp but was instantly hit. The line of Shot Cals weaved their way around the burning wrecks of friend and foe alike until they reached the firing ramps. The Shot Cals opened fire with precisely aimed, rapid fire. Geva’s tanks soon arrived on the firing ramps and added their weight of fire and were then joined by Lieutenant Colonel Ben-Hanan’s forces. Topping the next rise, Ben-Hanan saw a T-55 just 50 yards away. Shouting to his driver to stop, he ordered his gunner to fire. The Barak Brigade was back in the war. Battle was joined at close quarters with Israeli and Syrian tanks hopelessly intermingled but gradually the Syrians were forced back and the attack was broken, but at a cost. Both Ben-Hanan and Askarov were injured; Askarov critically with a gunshot wound to the head. Shortly afterwards, an observer in Mutzav 107 reported that the Syrian column of vehicles across the Purple Line was turning round and AFVs were falling back from the ‘Valley of Tears’. The battle was over. The 7th Armoured Brigade and the 188th Barak Armored Brigade had prevailed against overwhelming odds. As the battle subsided, the commander of the 36th Armored Division, Brigadier General Raful Eitan, came on the 7th Armoured Brigade radio net and announced: ‘You have saved the people of Israel.’

CHAPTER 2

VICKERS BATTLE TANKS

BACKGROUND

The engineering company of Vickers was involved in the production of tanks since their inception. The first Mark Is from 1916 were armed with 6-pdr guns manufactured by Vickers. After the Great War, the British government abandoned tank development due to various factors exacerbated by repeated financial crises. Combined with the Ten Year Rule that stated there would be no war in Europe within the next decade, the defence budget declined year on year. Tank design in Britain became the preserve of private industry and Vickers in particular. During the 1920s, the British Army was equipped mainly with the Vickers Medium Tank Mark I and Mark II. These were the first complete tanks built by Vickers at their River Don Works in Sheffield. There followed a much-enhanced design known as the '16-Tonner' or A6 Medium Mark III. This vehicle featured a fully rotating main turret mounting a 3-pdr gun with two machine-gun-armed sub-turrets. This influential configuration was repeated with the A1E1 Independent Heavy Tank weighing 32 tons. Neither of these tanks were adopted by the British Army due to financial constraints. Nor was another outstanding Vickers design – the 'Six-Ton Tank'.

However, all three tanks were highly influential abroad and formed the basis of several nascent tank industries, particular the Soviet Union's. The Independent inspired the German Neubaufahrzeug and the Soviet 45-ton T-35 Heavy Tank while the Six-Ton Tank became the T-26, of which there were 53 variants and 10,117 examples manufactured in the Leningrad Bolshevik Factory and the Stalingrad Tractor Factory up until February 1941. In 1928, the production of Vickers tanks, tracked vehicles and armoured cars moved from Sheffield to the Elswick Works in Newcastle. At the same time, the Vickers Design Establishment was created at Chertsey in Surrey. The principal designers were the brilliant engineer, Sir John Valentine Carden, and his chief, Mr C.O. Woodward. The latter tended to be responsible for heavier tanks while Carden worked on lighter designs.

Beside a whole host of light tanks and tankettes, Vickers produced the two first Cruiser tanks, the A9 and A10, to a War Office specification. Both tanks bore a similar configuration of turrets to the erstwhile 16-Tonner. The experience gained on

The Vickers 6-Tonner was a highly influential design during the 1930s that was purchased by eight foreign armies. As the T1E4 in America, it was the progenitor of the M3 Stuart light tank series. In Poland, it became the 7TP or 7-Tonne Polish armed with a 37mm gun and fitted with a diesel engine. Some 140 were in service at the outbreak of World War II and it was a superior tank to both the PzKpFw.1 and 2. Similarly the Soviet Union had over 10,000 in June 1941 when the Germans invaded but Stalin's purges of the armed forces left the army bereft of leadership with disastrous consequences. This T-26 with a radio antenna around the turret is seen on exercise with infantry during summer manoeuvres in 1938. (Getty Images)

these gave rise to another Vickers private design that became the Infantry Tank Mark III. It first appeared in 1940 and was named Valentine in honour of Sir John Carden who had died in a plane crash in 1935. Manufacture continued until 1944 by when 8,275 had been built with a further 1,420 in Canada that were supplied to the Soviet Union, as were 2,394 from Vickers. The chassis of Valentine was also used as the basis of a range of special purpose variants including the Bishop 25-pdr self-propelled guns; Archer 17-pdr tank destroyer; bridgelayer; mine flail; flamethrower and the Duplex Drive DD amphibious tank: a portent of the highly successful 79th Armoured Division – Hobart's Funnies.

In the post-war era, Vickers became the design parent of Britain's finest tank – the Centurion. Vickers manufactured 1,437 out of a total of 4,423 Centurions built, as well as 345 Armoured Recovery Vehicles (ARV). Of this total, some 2,500 were exported overseas and versions remain in service to this day, notably in Israel and South Africa. Thereafter, Vickers was heavily involved in the design, development and manufacture of the Chieftain MBT with prime responsibility for the turret and weapons systems. The Chieftain entered service with the British Army in 1967. The tank incorporated both heavy armour and a powerful 120mm main armament at the expense of mobility when foreign contemporary designs tended to follow the opposite path of higher mobility as against firepower and armour protection, such as the Leopard and AMX-30. By its very nature, Chieftain was far more complex that Centurion and never achieved the foreign sales success of the latter.

VIJAYANTA

At the same time, Vickers recognized a potential export market for a simpler and lighter main battle tank than either Centurion or Chieftain but with the excellent firepower conferred by the L7 105mm gun as fitted to later marks of Centurion. First and foremost, this MBT was to be simple to operate to suit less sophisticated users, with particular emphasis on hot weather conditions and providing as much crew

A Vickers Indian Pattern Light Tank Mark IIB of the 11th Light Tank Company escorts a convoy of trucks on the road from Mirali to Damdil during October 1937 in Waziristan on the North West Frontier of India. Some 70 years later, on 9 and 10 October 2007, Taliban militants ambushed a Pakistani army convoy on the same road, with almost 200 people killed and 50 houses in Mirali destroyed during the fighting. Plus ça change…

comfort as is possible within the confines of any tank. The new design was completed in 1961 as the 46.200T and featured various components from both Centurion and Chieftain such as the Leyland L60 engine and Merritt-Wilson TN12 transmission, but weighing over ten tons less than either Centurion or Chieftain. Fortuitously, the Indian government was seeking a new MBT to be manufactured in India. Since the Indians had neither the design nor industrial capacity to produce such an AFV, they sought a foreign proposal for a tank similar to but lighter than the Centurions that had served them well to date. In January 1961, a team of Indian armour specialists headed by the Army Chief of Staff, Lieutenant General L.P. 'Bogey' Sen – the Hero of Shalateng, visited Britain and Germany to study their respective propositions.

In particular, the Indian Army required a tank weighing no more than 40 tons; most bridges across the country were unable to support any greater weight, and an amphibious capability was also needed to cross inland waterways in case the bridges were inadequate. Firepower was a priority with a fully stabilized L7 105mm gun in a Centurion-type mounting. The design was to incorporate fabricated and welded armour plate rather than cast turret or hull components, since such foundry capability did not then exist in India. Furthermore, the prevalent argument at this time was that increasingly powerful HEAT anti-tank weapons would penetrate the maximum armour of any modern tank, so survival on the battlefield no longer depended on armour protection but on its mobility and agility. In August 1961, an agreement was reached between Vickers and the Indian government whereby Vickers was to create an AFV manufacturing facility at Avadi near Madras, now Chennai. Two prototypes were built to the 46.200T specification with the first appearing in February 1963 and the second in September. The former underwent trials in India in early 1964 and the latter with the British Army. After some modifications, the definitive 51.025T design became the Vickers MBT Mark 1 in 1964.

Further extensive trials followed in India in early 1965 and the tank was approved for series production in the same year with the first 90 MBTs built by Vickers at Elswick while stocks of components were fabricated for the subsequent manufacture of further tanks at the Heavy Vehicles Factory in Avadi. Over time all such components were made in India until almost all the tank was indigenously built. The new MBT was named Vijayanta, meaning 'victorious'. The first Indian Vijayantas were delivered to the army in 1967 and production continued until 1986, by when some 2,200 had been built. It remained in service until 2007, although in the latter years in war reserve. During that time, the tank was progressively improved from Mark 1 via 1A and then 1C with more modern fire-control systems, to the Mark 2 with additional Kanchan modular composite armour for increased protection to enemy fire. Several trials were conducted to replace the Leyland L60 engine and TN12 transmission, including the T-72 powerpack to increase commonality across the tank fleet, but without success. Other variants of the Vijayanta included an ARV; a bridgelayer tank designated Kartik; and a 130mm self-propelled artillery piece known as Catapult.

The Sino-Indian border conflict of 1962 highlighted significant failures in equipment, do'ctrine and logistical support that led to a concerted modernization and expansion of the Indian armed forces. Unfortunately, this could not be implemented before the eruption of the Indo-Pakistan War in September 1965 when again command and control above regimental level proved inadequate, as it did on the Pakistani side. Inevitably the war caused delay in the production of Vijayanta at Avadi. Although the Centurion proved successful during the conflict, the ageing Shermans and light AMX-13s were less so. The need for new tanks was now paramount. This was met over time by the procurement of the T-54/T-55 series in quantity, as well as Skot and Topas APCs, from behind the Iron Curtain. New armoured regiments were formed over and above the 15 that were in service during the 1965 war. Another seven regiments were raised at Ahmednagar, the home of the Indian Armoured Corps, from 1966. Originally, these units were designated Cavalry but became Armoured Regiments from 14 January 1967.

The first of these was the 65th Armoured Regiment that was formed on 1 September 1965; originally with Sherman IV and V tanks but subsequently with Vijayantas when it joined 1st Armoured Brigade. The 66th Armoured Regiment was raised on 1 September 1966 and again was equipped with Shermans until converting to Vijayanta in November 1968. It fought in the Indo-Pakistan War of 1971 as the integral armoured regiment of 15th Infantry Division. Of interest, the regiment adopted a Death's Head insignia that closely resembled that of the 17th/21st Lancers and it adorned all their Vijayantas despite official disapproval: the insignia also had the inscription 'Maan ya Veergati', - Honour or Valiant Death, which echoes the 'Death or Glory' of the 17th/21st Lancers. The 67th Armoured

The Vijayanta saw only limited combat with the Indian Armoured Corps since it arrived too late to see action during the Indo-Pakistan War of 1965, and the major military operations during the 1971 war were in East Pakistan, later Bangladesh. Nevertheless, it had a long career in the Indian Army and underwent significant improvements over time, particularly to the fire-control system. The original Vijayanta was equipped with a simple .50-cal ranging gun, like late-model Centurions and early Chieftains, but this was replaced by the indigenously developed Tank Fire Control System, evolved from the Marconi SFCS 600, and produced by Bharat Electronics Limited. Some 450 Vijayantas were so fitted before a more sophisticated Integrated Fire Control System, encompassing thermal imaging and stabilized sights, was adopted and validated but did not enter series production. Similarly, attempts to replace the inadequate L60 diesel engine did not come to fruition despite successful trials with powerpacks from Rolls-Royce, Detroit Diesel and the Indian company of Kirloskar, as well as that of the T-72 which was produced in India.

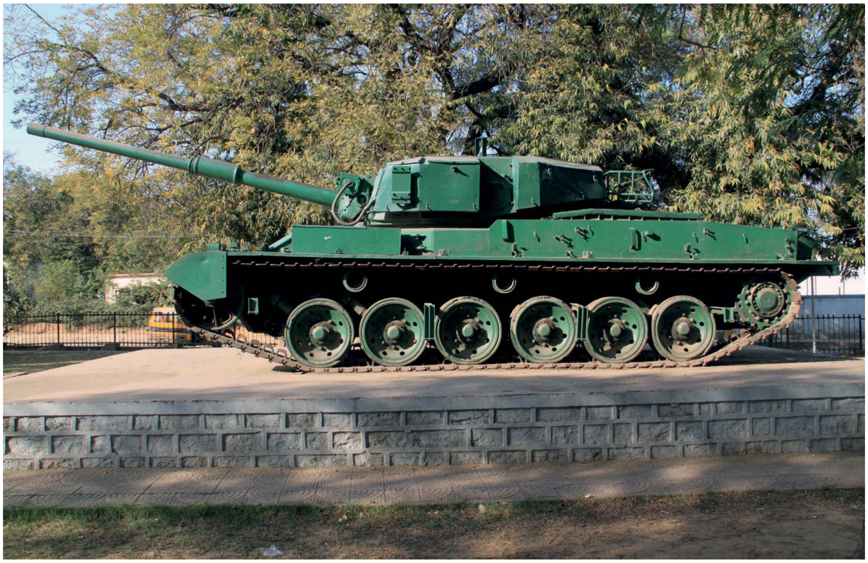
Regiment was raised on 15 September 1967 and was the first regiment to be equipped with Vijayantas built in India. Known as the Spearhead Regiment from its distinctive cap badge, the 67th has served in each of the three armoured divisions of the Indian Army. It served on the sidelines with the 1st Armoured Division during the 1971 war, as did the 68th Armoured Regiment that was raised on 1 March 1968 and also equipped with Vijayantas. Like the 67th, it did not see action in the Indo-Pakistan War of 1971 since the 1st Armoured Division was not committed to combat. The 85th Armoured Regiment was equipped with Vijayantas from the time of its inception on 1 October 1976. The regiment took part in Operation Trident during 1987 in the ongoing counter-insurgency operations in Jammu and Kashmir as well as Operation Rakshak or 'Protector' that continued the campaign in the region into the 1990s.

However, the very first regiment to be equipped with the Vijayanta was the 2nd Lancers (Gardner's Horse), one of the oldest and most decorated cavalry regiments in the Indian Armoured Corps, having first seen action during the Nepal War of 1815. It received its first Vickers-built Vijayantas on 10 August 1966. In 1968, the regiment joined 26th Infantry Division in Jammu. With the decision to equip the 1st Armoured Brigades with just Vijayanta units, the 2nd Lancers moved to that formation in December 1969. The 8th Light Cavalry converted from AMX-13s to Vijayantas in 1971 and came under the command of 3rd Armoured Brigade. The regiment supported 26th Infantry Division in the Jammu area during the 1971 war.

The raising of these new armoured regiments naturally coincided with a major influx of new equipment. Given that the Vijayanta design was limited to a weight of 40 tons (those built in India tended to be slightly heavier), its armour protection was less than Centurion or the T-54/55 series. Unfortunately, the corollary of increased mobility and agility was never fully realized as the L60 engine was underpowered and prone to overheating, while the tracks were too narrow which resulted in high ground pressure. To the user, the Vijayanta was inferior to the T-54/55 with its robust diesel engine, effective armour and adequate firepower of its 100mm gun. Furthermore, the production rate of Vijayantas at Avadi fell short of targets year after year, necessitating the import of yet more T-54/55s to make up the shortfall. However, the experience gained by the Heavy Vehicles Factory with Vijayanta formed the basis of a successful tank industry in India culminating in the manufacture of India's first truly indigenous MBT design – the Arjun – as well as assembly of the Russian T-90S Bhishma.

VICKERS MBT MARK 1

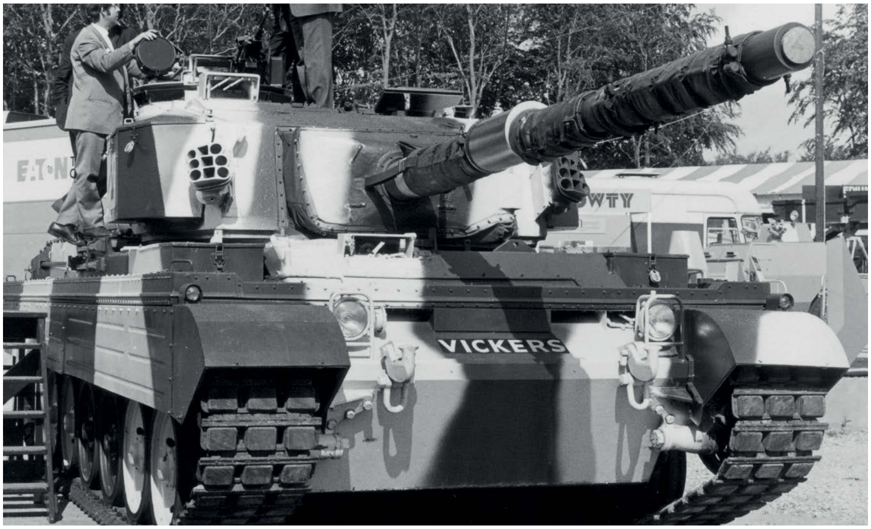
The Vickers MBT (V-MBT) had a conventional layout similar to Centurion, with the driver's compartment at the front together with ammunition stowage for 25 105mm rounds beside the driver's position; a fighting compartment with a fully rotating turret in the centre; and the engine and transmission compartment at the rear. All were contained within a welded rolled steel hull and turret of armour plate. Power was produced by the Leyland L60 engine and TN12 transmission with six forward and two reverse gears. With an output rating of 535bhp, the diesel L60 was adequate to power a tank weighing 37 tons, unlike in the 50-plus-ton Chieftain when it proved to be chronically unreliable. With a power-to-weight ratio of 14.5bhp



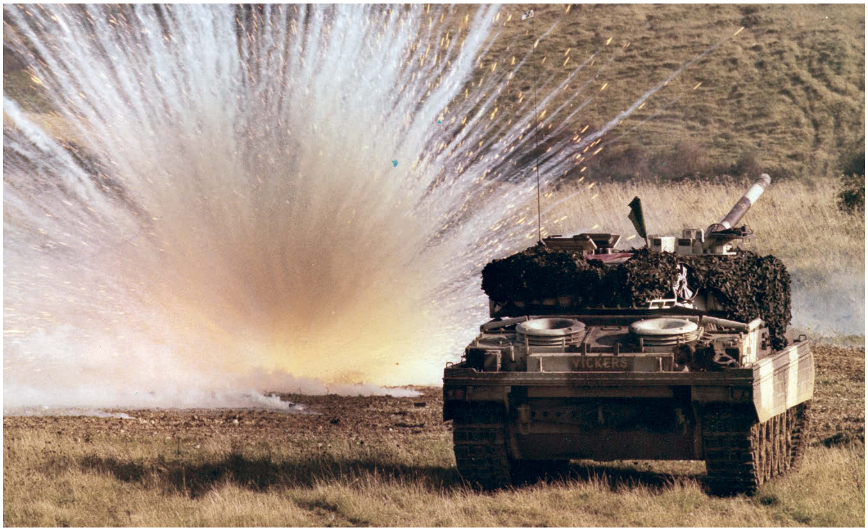
The Vijayanta was a highly important MBT in the modernization of the Indian Armoured Corps and the first to be manufactured by Indian industry between 1965 and 1989. The Vijayanta ended its long career with the Indian Army as a training tank and the basis of several special purpose variants. These included the Catapult 155mm self-propelled gun; the Kartik AVLB and Vijayanta ARV. Its final role was as dug-in pillboxes along the Line of Control in the disputed province of Jammu and Kashmir, with the tanks acting as mobile artillery weapons. Many Vijayantas remain as memorials across the country, such as this one on Gandhi Road in Gwalior. (Courtesy of Jenny Spencer-Smith)

per ton, the V-MBT had a range of 300 miles and a maximum speed of 30mph. The complete powerpack comprising engine, transmission and cooling group could be replaced as a single unit for easier repair and maintenance in the field. In addition to a 24-volt generator belt-driven off the main engine, an auxiliary Coventry Climax H30 three-cylinder engine powered a second generator to provide turret power and charging of the batteries when the main engine was not running.

As was customary with British tanks, the driver steered by means of two tiller sticks controlling hydraulically applied disc brakes. He was provided with a single AFV No.44 Mark 2 day periscope for driving when closed down that could be replaced by a passive image-intensifier periscope for night driving. The turret housed the remainder of the four-man crew with the commander, gunner and loader. The main armament was the well-proven Royal Ordnance L7A1 105mm gun that fired a wide range of ammunition including the L28A1 APDS-T; L52A1 APDS-T; L64 APFSDS-T; L37 HESH; L39 Smoke as well as practice rounds. In all, the tank



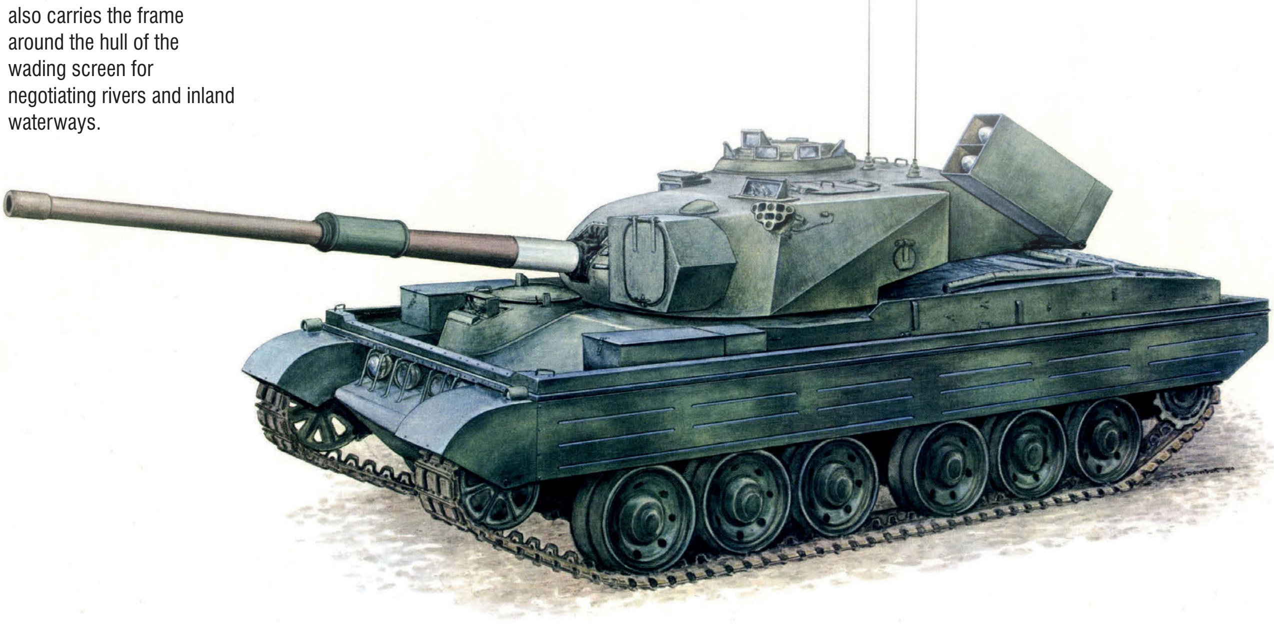
The main armament of the Vickers MBT was the well proven L7A1 105mm gun fitted with a thermal sleeve combined with a .50-calibre ranging gun that fires three round bursts linked to a ballistic range reticule. This system was simpler than contemporary complex optical, either coincidence or stereoscopic, rangefinders. There were also two sets of six smoke discharger cups, with one on each side of the turret.



A White Phosphorous grenade explodes as a Vickers Mark 1 MBT undertakes a firing run on the Lulworth gunnery ranges in Dorset. The two cooling cowls above the transmission compartment indicate that this V-MBT features the Detroit Diesel 720bhp engine. The tank is painted in the white and anthracite camoflage scheme that Vickers adopted to attract foreign customers. A primary design feature was simplicity of operation and crew comfort in hot climates.

carried 44 main armament rounds. Like Centurion and Chieftain, the V-MBT incorporated a .50-calibre (12.7mm) ranging gun mounted coaxially with the main armament. This fired three-round bursts of tracer ammunition out to a range of 1,800 yards to determine the distance; it worked by observing the fall of shot, since the rounds had a pyrotechnic tip that ignited when striking a hard target. Such a system was both cheaper and simpler than optical rangefinder instruments and also took into account such factors as cross winds and the cant of the gun trunnions: both important factors in hit probability. In one demonstration shoot, a V-MBT Mark 1 hit ten targets at varying ranges between 600 and 1,000m in just 55 seconds. In addition, there was a coaxial 7.62mm machine gun with 3,000 rounds for engaging infantry and other battlefield targets and another at the commander's cupola.

Like Centurion and Chieftain, the V-MBT was fitted with an all-electric gun control and stabilization system that allows a target to be tracked effectively while moving due to the gunner's primary sight being stabilized separately: a particular innovation on the V-MBT. As was standard practice at the time, the tank then came



An artist's impression of the Vickers MBT Mark 2 shows the new turret incorporating integral Swingfire ATGW launchers and the armoured searchlight housing as designed for Chieftain. It also carries the frame around the hull of the wading screen for negotiating rivers and inland waterways.

to a halt and the gunner made his final adjustments within seconds before engaging the enemy target. Being all-electric, the system gave greater battlefield survivability than those using hydraulics. Another advantage of the stabilization system was the ability to put down effective prophylactic co-axial machine-gun fire against infantry and any position likely to shelter anti-tank teams whilst advancing at speed. It was also feasible to use the ranging gun to fire heavier-calibre rounds at other targets such as trucks or buildings although this was not officially encouraged as there were only 600 rounds for the weapon.

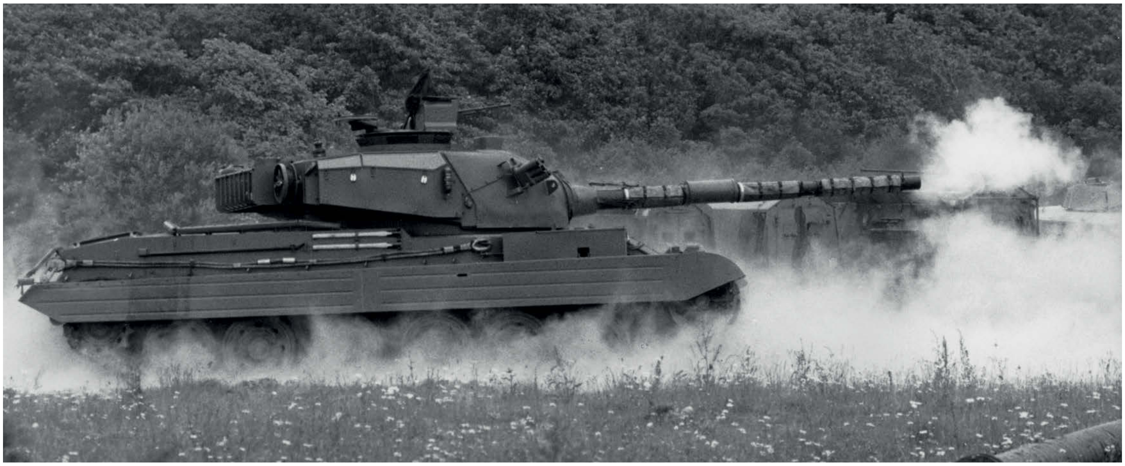
Unlike Centurion and Chieftain with their Horstmann suspension systems, the V-MBT employed torsion bars with six dual rubber-tyred road wheels with the idler at the front, drive sprocket at the rear and three track-return rollers. Suspension units one, two and six incorporated secondary torsion bars that were brought into action by stops mounted on the hull. The first, second and sixth road wheel stations were provided with a hydraulic shock absorber. The tracks were of cast manganese steel; each of 96 links with removable rubber pads to minimize damage to roads. Optional equipment included an NBC (nuclear, biological and chemical) protection system; night-vision equipment with an infra-red/white searchlight mounted to the left of the main armament and a flotation screen carried collapsed around the top of the hull that took between 15 and 30 minutes to erect. The tank could then be steered and propelled in the water by its tracks at a speed of 4mph. The tank had a fording depth of 1.143m without preparation.

VICKERS MBT MARK 2

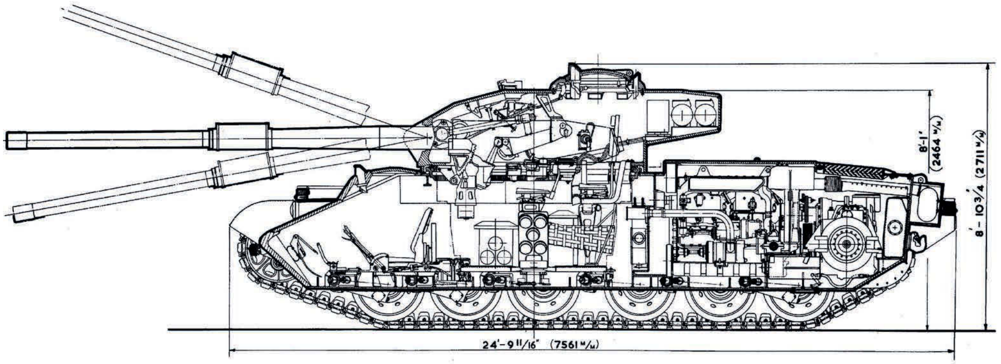
In 1968, Vickers proposed an improved model with a new turret incorporating a cast front with a mantletless gun mounting for greater armour protection. Following Indian criticism, the tracks were widened and given increased length on the ground by moving the rear wheel stations backwards to give reduced ground pressure. A revised L60 engine of 650bhp output was proposed together with redesigned final drives to give a higher top speed of 35mph as against 30mph of the Mark 1. For greater firepower and the ability to engage targets at long range, two pairs of BAC Swingfire ATGMs with a range of 4,000m were mounted in bins on each side of the turret rear. Four spare missiles were to be carried on the tank. The feasibility of installing Swingfire ATGM was tried on a V-MBT Mark 1 and displayed at the Farnborough Air Show in 1968. In the event the Mark 2 did not proceed beyond the mock-up stage but introduced several features that were incorporated into the Vickers MBT Mark 3.

VICKERS MBT MARK 3

In 1969, Vickers undertook the installation of the General Motors Detroit Diesel Model 12V-71T in place of the Leyland L60 while retaining the TN12 transmission. The fitting of the GM engine necessitated some radical changes within the engine compartment, primarily with the cooling group and the elimination of the auxiliary engine. The result was an engine output of 720bhp with a power-to-weight ratio of 18bhp per ton. This diesel powerplant was used in the V-MBT Mark 3 that appeared in 1972 as design 51.90-0T. The turret front was completely redesigned with a



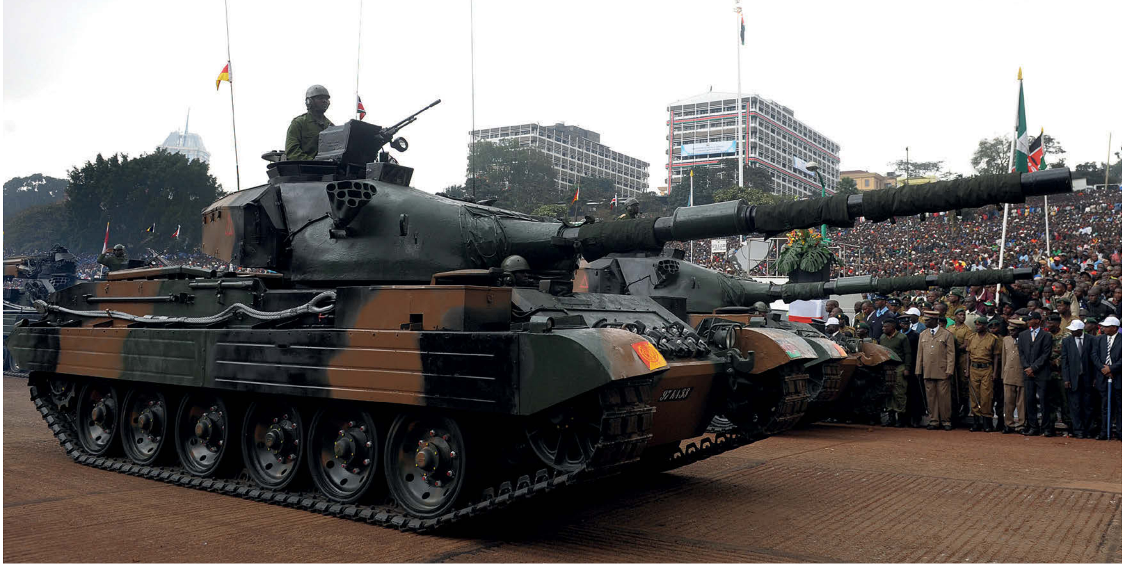
ABOVE A Vickers Main Battle Tank Mark 3 fires its main armament during trials. This version featured a turret with a cast front with a similar configuration to Chieftain giving greater ballistic protection. The vehicle carried 50 rounds of main armament ammunition including APFSDS, APDS, HEAT, HESH, HE, Smoke and Canister. An ARV and Bridgelayer were also produced on the Mark 3 chassis.



RIGHT A cross section of a Vickers Main Battle Tank Mark 3 illustrates the relative sizes of the different constituent parts including the driver, fighting and engine/transmission compartments. Of particular note, the elevation and depression range of the 105mm main armament is shown to advantage from +20° and -10°: the latter being of distinct tactical merit when firing from hull down positions or from a reverse slope and a particular feature of British tank designs.

configuration similar to Chieftain, giving superior ballistic shape and therefore protection. Among the other improvements were an enhanced transistorized Marconi EC620 gun control system; a Marconi SFC600 fire-control system incorporating a Barr & Stroud laser rangefinder; increased ammunition stowage to 50 main armament rounds; a commander's cupola with a Pilkington PE Condor combined day/night sight; and the L7A1 105mm gun (which now incorporated a thermal sleeve for improved accuracy) could be depressed to minus 10 degrees as against minus 7 degrees of the Mark 1. Of particular note, the weight of the new MBT when combat loaded was virtually the same as the Mark 1 at 38.7 tonnes.

As with many successful designs, a range of special-purpose variants was developed on the Mark 3 chassis. First and foremost was an ARV with a cast superstructure housing a main capstan winch with a direct pull of 25 tons and a maximum of 65 tons with multi-reeving of the recovery cable. The vehicle incorporated an Atlas crane similar to that of the Chieftain ARRV (Armoured Recovery and Repair Vehicle) to allow complete powerpacks to be exchanged in the field. A front-mounted anchor spade provided stability during recovery or lifting operations. In addition a spare powerpack could be carried above the engine decks beside the crane. The second major variant was the Mark 3 Armoured Vehicle Launched Bridge or AVLB. Vickers was a leading producer of military bridging equipment and manufactured the

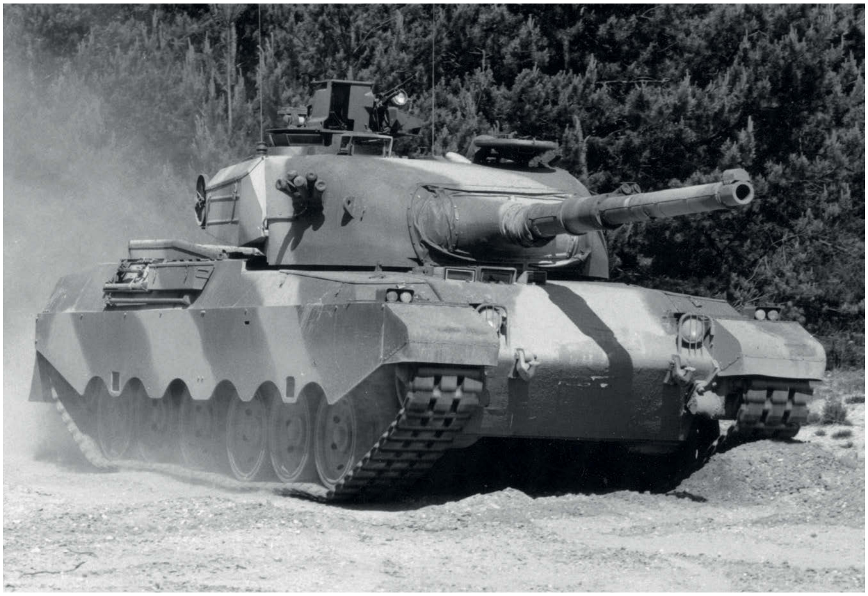


The Kenyan Army procured 76 Vickers Mark 3 MBTs and seven ARVs that equip the 78th and 81st Tank Battalions. The tanks have seen extensive service in combat operations against the Al-Shabab terrorist organisation as have the Nigerian Vickers MBTs against Boko Haram. Here, two Vickers Mark 3 MBTs and an ARV, at extreme left, in their distinctive camouflage scheme of black, orange and green, pass the dais of President Mwai Kibaki during a parade at Uhuru Park on 27 August 2010. (Getty Images)

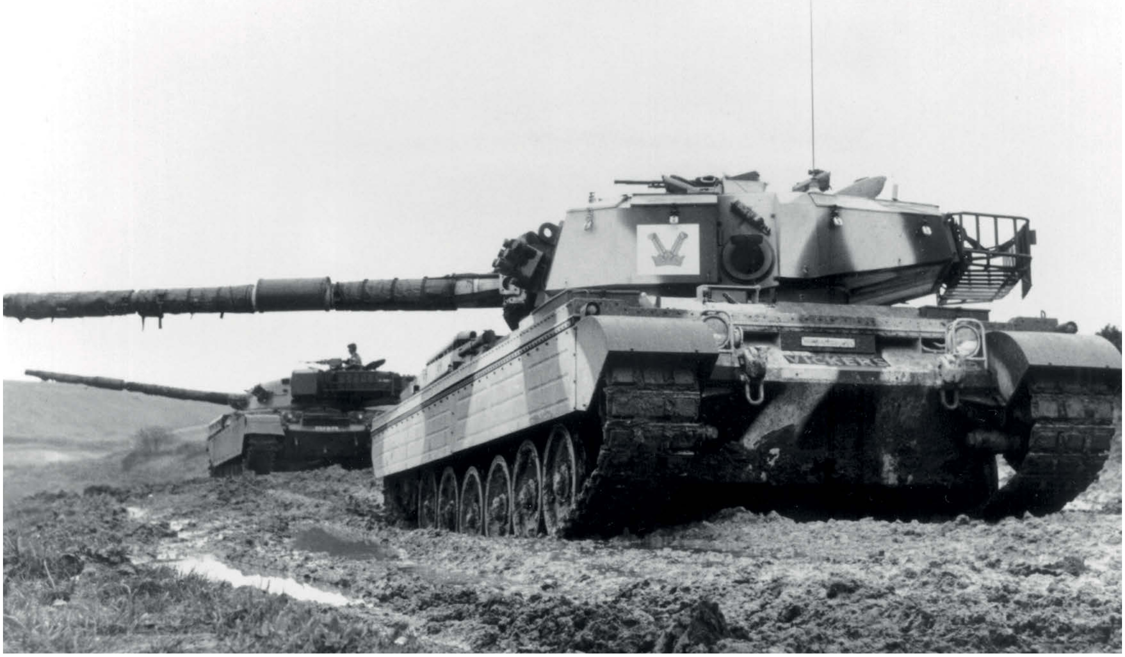
Chieftain AVLB for the British Army. The same hydraulic bridging system was used for the Mark 3 AVLB that was able to span a gap of 12m with a bridge capable of supporting AFVs with a 60/70-ton weight classification. The Tank Bridge No.9 was carried in a horizontal position and launched through 180 degrees over the front of the vehicle.

VICKERS MBT MARK 3 (IMPROVED)

Vickers was constantly seeking new technology to enhance its MBT series and in 1986 revealed the Mark 3 (I) or Improved. This version featured a cast glacis plate and an increased ground clearance of an inch or 25mm to allow greater wheel travel for better battlefield agility. Mobility was improved by the installation of the Perkins Engines CV12 TCE diesel developing 850bhp coupled to the Self Changing Gears T1200 transmission with six forward and two reverse gears. Both could be removed as a



The Vickers Main Battle Tank Mark 3 (I) indicating Improved incorporated a cast turret and glacis plate as well as numerous other enhancements including the V800 powerpack with the GM 12V-71T turbocharged diesel engine and fully automatic TN12 MarkV5 gearbox. The Mark (I) featured a sophisticated fire control system with a Pilkington PE Condor commander's day/night sight combined with a Barr and Stroud Tank Laser Sight.



With the company logo and name emblazoned on the turret side and glacis plate, a Vickers Main Battle Tank Mark 1 undertakes a firing run on the gunnery ranges at Lulworth in company with a Chieftain Mark 3. The Vickers MBT was primarily designed for the export market and was sold in quantity to India and Kuwait.

complete powerpack. This combination gave a top speed of 37mph with a range of 376 miles. The ride characteristics were modified by the fitting of rotary dampers to the first, second, and sixth wheel station on each side to give a better fire-on-the-move capability. This in turn was upgraded by the Marconi Command and Control Systems EFCS 600 computerized fire-control system and the EC 620 all-electric gun control equipment. Firepower was also improved by fitting the L7A1 105mm tank gun with an integral rigid thermal sleeve to reduce barrel distortion caused by temperature differences after firing, to give more consistent accuracy. The latter was further enhanced by incorporating a muzzle reference system that allowed the gun and sight alignment to be corrected from within the turret whenever the gunner desired. As with all versions of the Vickers MBT series, there was a range of optional extras, such as an NBC protection system, depending on the requirements of the customer.

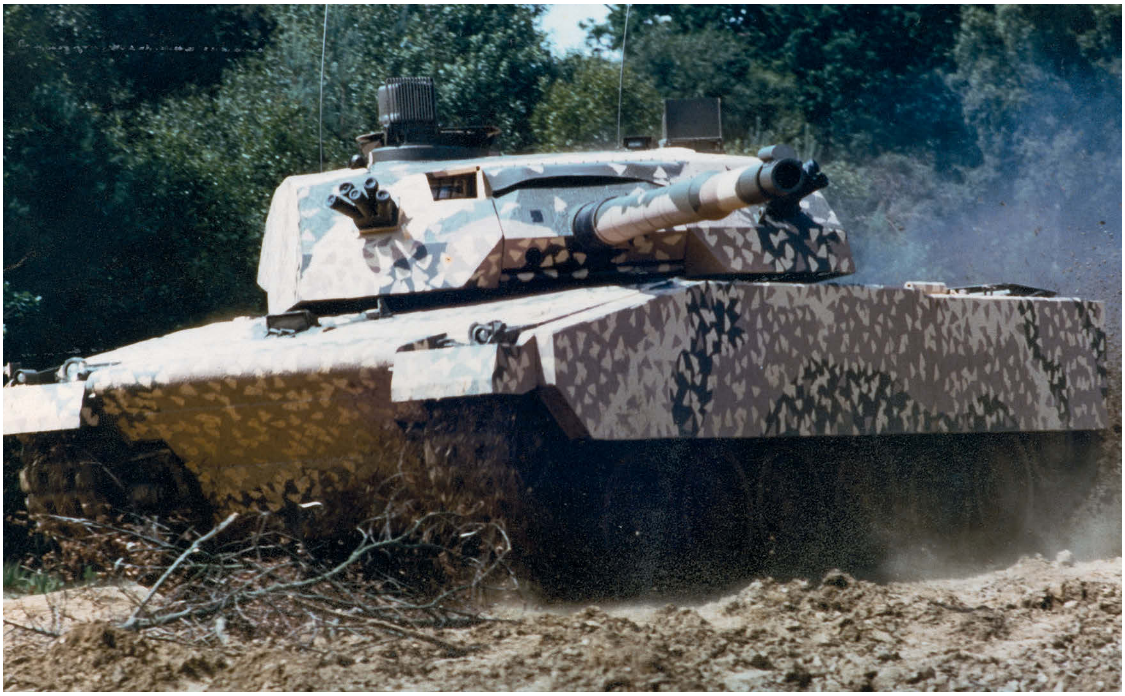
FOREIGN SALES

Beside the 2,200 Vijayantas that were built by Vickers and in India, the Vickers MBT Mark 1 was purchased by Kuwait, which procured 70 between 1970 and 1972. By the time of the Gulf War in 1991, most of these were in storage but were appropriated by the Iraqis as they did with so much Kuwaiti equipment. In 1977, Kenya placed an order for 38 Vickers Mark 3 MBTs plus three ARVs, which were all completed by late 1980. In December 1978, Kenya placed a second order for 42 Vickers Mark 3 MBTs plus four ARVs that were delivered between 1981 and 1982. In August 1981, the Nigerian government placed an order worth some £60 million for 36 Vickers Mark 3 MBTs, five ARVs and six bridgelayers. The MBTs were fitted with the Detroit Diesel 12V-71T engine; the David Brown Defence Equipment TNI2 V5 transmission; the British Aerospace Systems and Equipment-York L23 gunner's sight incorporating a Simrad LV352 laser rangefinder; the Pilkington Optronics Condor commander's day/

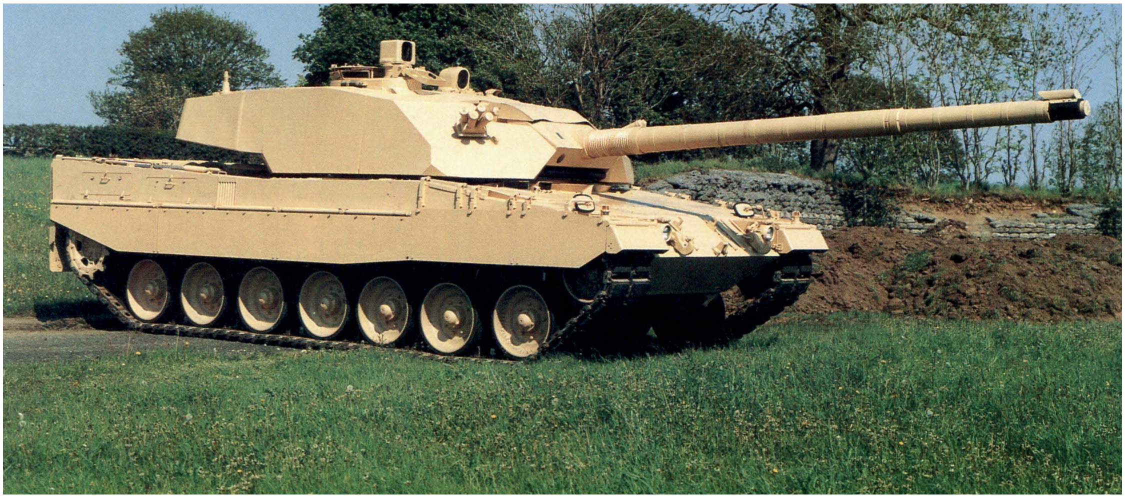
night sight and the GEC-Marconi Radar and Defence Systems EFCS 600 fire-control system. First production vehicles for Nigeria were completed in mid-1983. Early in 1985, Nigeria placed an order for another 100 Vickers Mark 3 MBTs with the first deliveries made late in 1992 and final deliveries in late 1995. In addition, a further batch of ten ARVs and 12 AVLBs was procured. In 1989, Tanzania puchased four Mark 3 ARVs to support its Chinese-supplied Type 59 MBTs. It is interesting to note that more Vickers MBTs were manufactured than Chieftains.

VICKERS MBT MARK 4 VALIANT

In 1976, the British government announced the development of Chobham armour, a revolutionary form of protection for AFVs, particularly against hollow-charge HEAT weapons. Soon thereafter Vickers was provided with technical data concerning Chobham armour, while two of the company's directors were seconded to the Ministry of Defence Chobham Armour Committee. Vickers immediately began the development of a tank incorporating the new armour. In order to reduce overall weight, the hull was constructed of aluminium with Chobham armour panels attached along each hull side. The turret was fabricated of steel with Chobham armour added to the front and sides. The initial armament was the well-proven L7A1 105mm gun. The tank was first fitted with the General Motors Detroit Diesel 12V-71T engine developing 915bhp and subsequently with the Perkins CV12 TCA, as installed in Challenger 1, but derated to 1,000bhp. This gave a power-to-weight ratio of 23bhp per ton as against 14.5 for the V-MBT Mark 1, despite the increased weight of 47 tons. The first prototype of the Vickers Mark 4 was completed in June 1979 and demonstrated at the British Army Equipment Exhibition of 1980, together with a mock-up of what was designated the 'Universal Turret' mounting a 120mm L11 tank gun.



The Vickers Main Battle Tank Mark 4 was the first to incorporate Chobham armour for the turret, hull and along the hull sides. The tank was named Valiant after a previous Vickers wartime design. Here, a Vickers Valiant speeds across country adorned in an impressive disruptive camouflage scheme incorporating experimental IR suppressive paint.



Introduced in 1985, the Vickers Main Battle Tank Mark 7 was essentially the combination of the Vickers Valiant turret and the Krauss Maffei Leopard 2 chassis developing 1,500bhp. Designed primarily for export, the turret was offered with either the L11A5 120mm rifled gun; the Rheinmetall L44 120mm smoothbore, or the GIAT CN-120 F1 120mm smoothbore gun.

The latter was extensively developed with the latest technology including independently stabilized sights and thermal imaging for both the gunner and commander, giving what was then termed a comprehensive ‘hunter-killer’ capability. This allowed the commander to acquire and identify enemy targets independently of the gunner’s line of sight. The commander then aligned both viewpoints to allow the gunner to make final adjustments and engage the target. Meanwhile the commander sought other targets on the battlefield; thus speeding up the whole process of tank-vs-tank engagements by day or night. This system also allowed the commander to fire the main armament as necessary. The whole weapon system was managed by the Marconi Radar and Control Systems’ Centaur fully integrated gun and fire-control system that was integrated with a ballistic computer for rapid and accurate aiming while taking into account numerous factors such as ammunition type, barrel wear, trunnion tilt, wind speed etc.

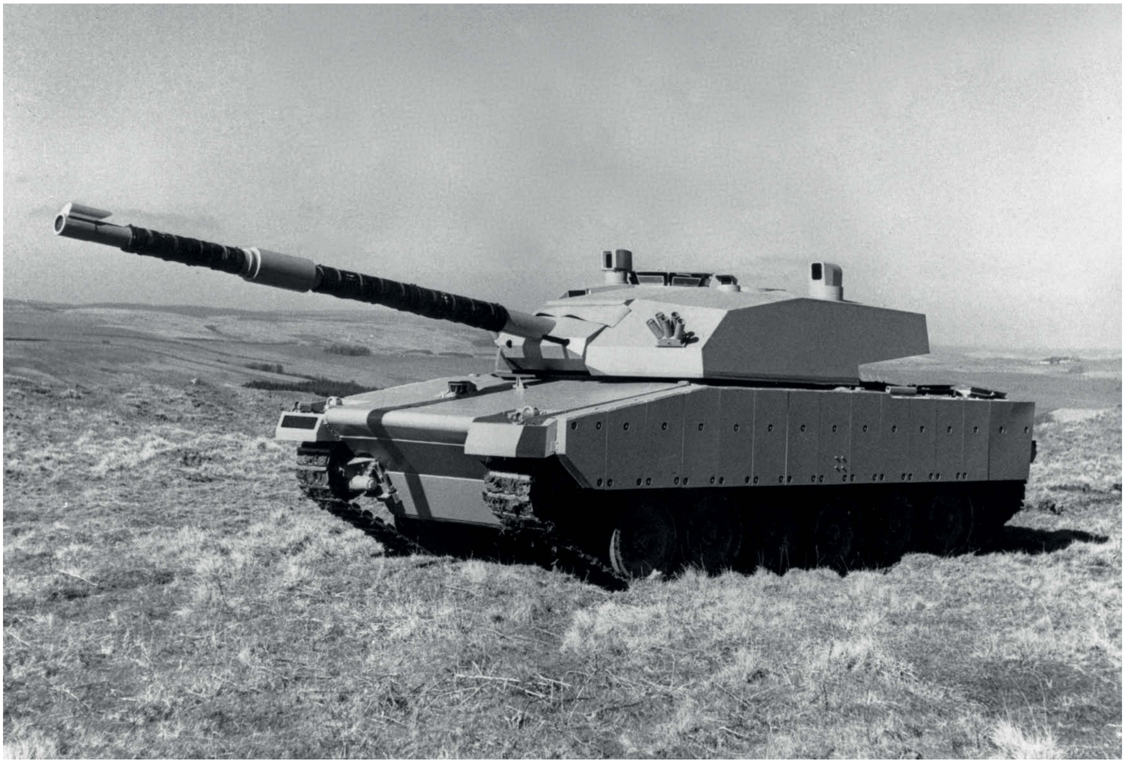
The turret was also designed to accept the L7 105mm, the L11 120mm or the Rheinmetall and GIAT 120mm smoothbore guns. Secondary armament was the Hughes 7.62mm chain gun with either a .50-calibre or 7.62mm machine gun at the commander’s cupola. The upgraded version with the Universal Turret was exhibited at the British Army Equipment Exhibition in 1982 under the new designation of Vickers Valiant. However, the Valiant did not enter production mainly due to the lack of rigid stability of the aluminium hull and unsatisfactory centre of gravity. Nevertheless, further development of the Universal Turret led to a version for the Brazilian Engesa EE-T1 Osório MBT armed with a GIAT 120mm smoothbore gun and to the Vickers Mark 7 MBT with a more successful outcome.

VICKERS MBT MARK 7

Given the problems with the hull of the Vickers MBT Mark 4, the company found an elegant solution in marrying the Valiant turret with the chassis of the Krauss Maffei Leopard 2A4 to become the Vickers MBT Mark 7. The first prototype was produced in June 1985 fitted with an L11 120mm gun and underwent hot weather trials in Egypt during September. In the following year, the turret weapons and fire control systems were further modernised to incorporate the latest technological developments.

These included a second-generation roof-mounted thermal sight with greater resolution and variable magnification; an upgraded Centaur fire-control system; improved main armament stabilization and an enhanced Nanoquest L30 telescopic laser sight. The Leopard 2 chassis provided a highly stable firing platform for the uprated turret. The powerpack comprised the MTU 873 Ka-501 diesel engine rated at 1,500bhp coupled to the Renk HSWL 354/3 gearbox providing four forward and two reverse gears. With a combat weight of 54 tons, the Mark 7/2 had a top speed of 45mph and a range of 340 miles. Following the disastrous Canadian Army Trophy NATO gunnery competition of 1985, a comparison shoot was undertaken between a Challenger 34KA66 and the Vickers Mark 7 68MS46 on 2 October 1987. Eight targets were presented to each tank. The Challenger engaged them and hit seven with one miss at an average engagement time of 21.7 seconds. The Vickers MBT hit all eight at an average time of 12.5 seconds. There was no escaping the fact that the Challenger's fire-control system was hopelessly outmoded compared to the current generation of MBTs. The experience gained with the MBT Mark 7 was to prove invaluable in the development of the turret of Challenger 2, which was designed and manufactured by Vickers and entered service with the British Army in May 1994.

In its final entity as Vickers Defence Systems (VDS), the company was acquired by Alvis Plc in October 2002 to become Alvis Vickers, which in turn was purchased by BAe Systems in June 2004. With this final takeover, the name of Vickers was lost forever after 176 years in business. Its Armstrong Works at Scotswood Road, Newcastle-upon-Tyne, was the last tank-producing facility in Britain. It was closed down in September 2013. The country that developed the first tank to see combat in September 1916 did not achieve a century of tank manufacture and is now obliged to purchase all its AFVs from abroad.



With its ability to mount different main armaments including the L7 105mm gun, the Mark 7 featured a Universal Turret to suit any requirement of a potential customer. The Universal Turret was chosen by the Brazil for installation of the indigenously built Engesa EE-T1 Osório Main Battle Tank. Two prototypes were built in 1986. The first was armed with the L7A3 105mm gun and the second the GIAT CN-120 F1 120mm smoothbore gun.

CHAPTER 3

CHIEFTAIN

Although the British invented the tank and used it to telling effect in the final offensives of the Great War, further development withered on the vine in the years of post-war austerity and the conflicting demands of policing a worldwide empire. It was the defeated Germans who saw the full potentiality of the tank and, with the rise to power of Adolf Hitler, the concept of Blitzkrieg was nurtured with devastating consequences. In the early years of World War II, the Panzers of the triumphant Wehrmacht swept all before them. Throughout the war, British tank designs lagged behind their German counterparts in terms of firepower and armour protection. Moreover, most suffered from chronic mechanical unreliability. The situation was exacerbated by having different classes of tanks for infantry support and offensive operations, which squandered scant resources and militated against a coherent armoured doctrine. By 1944 Field Marshal Montgomery and others were advocating the concept of a Universal Tank to replace the discredited Infantry and Cruiser classes of tanks, but this idea was not pursued until after the war had ended.

The design of the so-called Universal Tank began in 1946 under the designation A45 just as the final example of the Cruiser class of tanks, the Centurion, was entering service with the British Army. However, development of the A45 was slow and the Universal concept was severely compromised when it proved too difficult to modify the design for special-purpose tasks such as amphibious assault or minesweeping. The A45 was abandoned in 1948 in favour of further development of the Centurion. Ironically, the latter was able to be adapted to most of the roles envisaged for the Universal concept and it proved to be the outstanding tank of its generation. Yet, the Universal concept is specific and it was not to be realized for some years until the emergence of the first true main battle tank for the British Army – the Chieftain.

DESIGN AND DEVELOPMENT

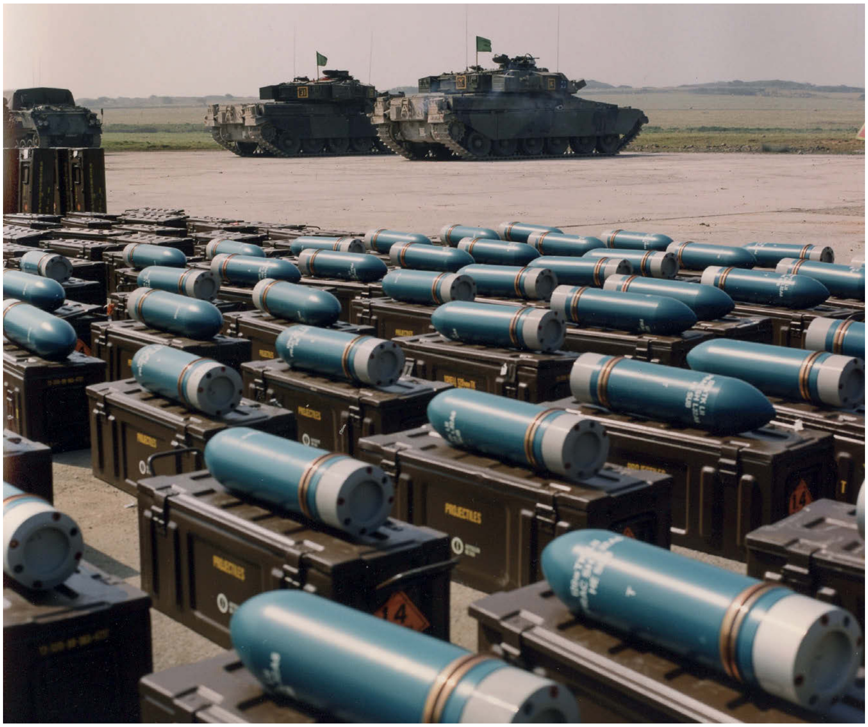
The development of a successor to the Centurion began in 1951 under the designation Medium Gun Tank No.2. Following the turmoil of tank development during World War II, the designers were given free rein to explore new technologies without the constant demands of the Army to field the latest untested models to counter the

A full regiment of Chieftains of the 5th Royal Inniskilling Dragoon Guards deploys onto the Salisbury Plain Training Area (SPTA), together with support vehicles, to conduct combined-arms exercises with armoured infantry in the summer of 1995.

superior German Panzers that had exacted such a fearful toll of Allied tanks from North Africa to Northwest Europe. The threat was now posed by the massed armoured forces of the Soviet Union and its Warsaw Pact client states. The Soviet bloc was equipped with thousands of effective medium tanks such as the T-34/85, supported by hundreds of heavy tanks including the IS-3 with its powerful 122mm main armament. To counter such numbers, the western Allies pursued a strategy of quality over quantity, but in the early 1950s the only NATO countries manufacturing tanks in any numbers were Britain and the USA. Accordingly, the two nations co-operated in many facets of tank design including a desire for a standard main armament. To this end, the priority for the Medium Gun Tank No.2 was firepower over armour protection or mobility. Mobility was not neglected, however. It had to be at least as good as the Centurion's, with the emphasis on battlefield agility rather than a high top speed. The gun/armour combination would be determined by the overall weight of the vehicle, which the General Staff required to be less than 45 tons. Radical innovations would be needed to meet such a weight limit and these were addressed in a wide-ranging research process known as the Concept Study Programme.

At the outset, the US T-104 105mm gun firing HVAP, AP and HEAT rounds was proposed together with a 100in turret ring to allow a well-sloped glacis plate for greater armour protection over the frontal aspect. However, the T-104 was a massive weapon and the handling and stowage of its ammunition within the fighting compartment posed insurmountable problems when using normal one-piece rounds with brass shell casings. The solution was to provide an automatic loader, but this was deemed to be overly complex and unreliable and allowed space for only 40 rounds to be stowed under armour.

In 1953, after consultation between the weapons designers at the Armament Research and Development Establishment (ARDE) at Fort Halstead and the tank designers at the Fighting Vehicles Research and Development Establishment (FVRDE) at Chertsey in Surrey, it was decided to investigate the feasibility of liquid-propellant guns. This technology offered several significant theoretical advantages, including simpler ammunition handling, as the loader had only to manhandle the projectile and not the shell casing, and a marked increase in muzzle velocity: the

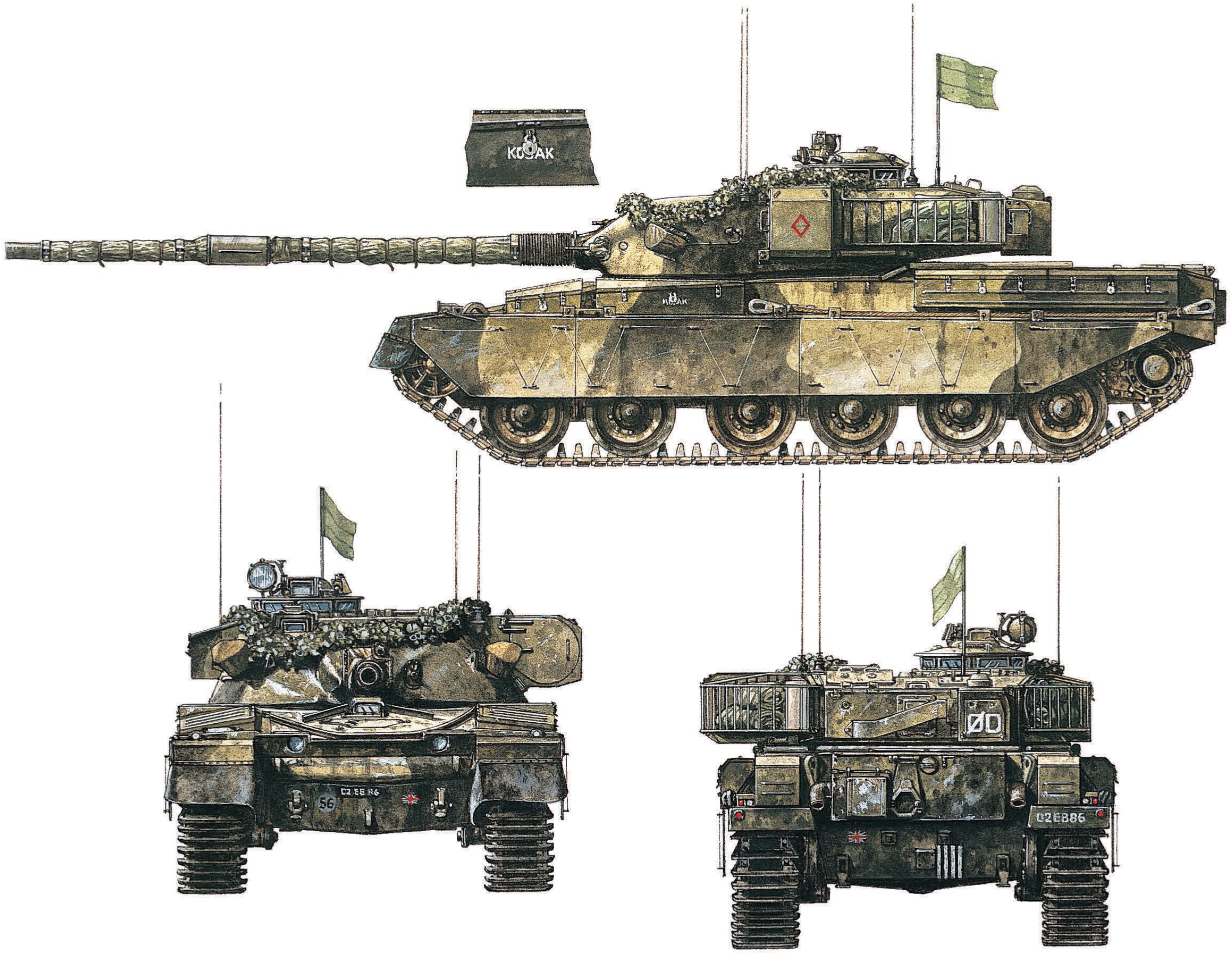


The High Explosive Squash Head or HESH shell was the preferred high explosive round in the British Army from the 1950s onwards. HESH has a dual capability against both field fortifications and hard targets such as tanks. The latter were defeated by creating shock waves to homogenous rolled armour that detached red-hot metallic scabs from the interior of the turret with dire consequences for the crew inside. The blue colour of these 120mm shells indicate they are practice rounds as Chieftain MBTs undertake gunnery training on the ranges at Castlemartin in Wales.

higher the muzzle velocity, the greater the armour penetration. The project demanded a considerable amount of development and testing of gun installations with the complex feed system for the volatile liquid propellant, but the design team was minuscule with inadequate resources and the concept came to naught, primarily because the liquid propellant reservoir grew to overly large proportions in order to withstand the necessary pressures for the system to function.

Nevertheless, much useful data was accumulated which benefited other projects that were being pursued simultaneously. One of the most promising was the bagged charge concept, which had been successfully used by the world's navies for many years. Its application in a tank was novel and presented several advantages over fixed one-piece ammunition. The main benefits were easier handling within the fighting compartment for the loader, and increased stowage space to allow more rounds to be carried. The weight of the metal cases was saved and no provision had to be made to collect the spent cases inside the turret for subsequent disposal. In addition, the hazard of noxious fumes from the spent cases was eliminated. In essence, the loader rammed a projectile, be it AP or HE, into the breech followed by the bagged propellant charge. A vent tube primer then ignited the charge, which was totally consumed in the subsequent explosion. Trials demonstrated that the use of two-piece ammunition did not markedly reduce the rate of fire from the desired six rounds a minute. There were however severe reservations concerning the risk of catastrophic ammunition fires if the bagged charges in their stowage bins were penetrated by red-hot fragments – the most dreaded hazard for tank crewmen.

Ammunition fires had been the cause of many fatalities during World War II, particularly in tanks that stowed their ammunition in the turret. As the highest part of the tank, the turret was most likely to be hit by direct-fire weapons and, if penetrated, any rounds stowed inside were likely to be ignited, with dire consequences

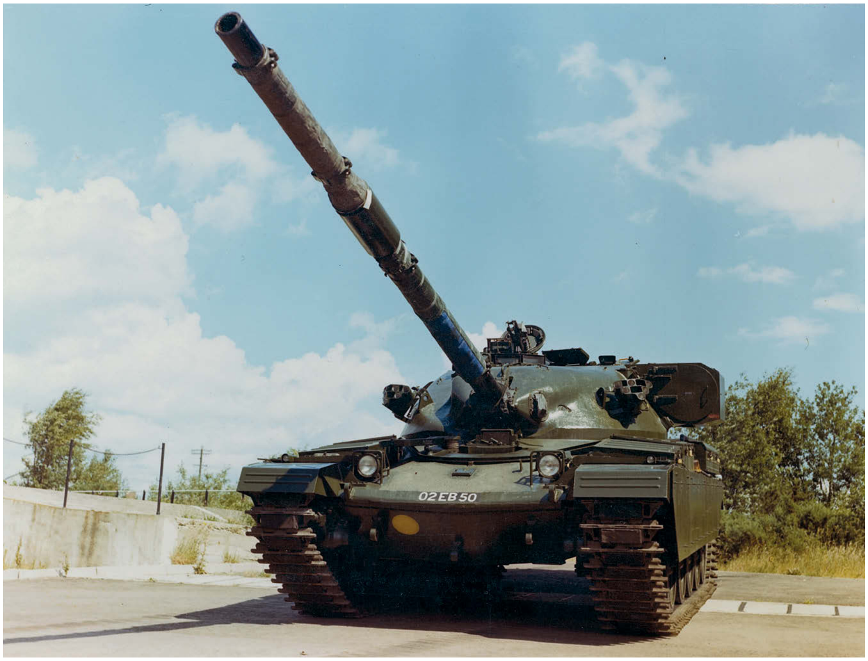


CHIEFTAIN 2(Y)/L, HEADQUARTERS SQUADRON, THE QUEEN'S ROYAL IRISH HUSSARS, PADERBORN, BAOR, 1978

This three-view colour plate shows the typical temperate zone British Army camouflage scheme of the Chieftain MBT throughout its career of dark green and disruptive black stripes. The red diamond on the searchlight housing denotes Headquarters Squadron within the armoured regiment. The vehicle callsign Zero Delta is carried on a black metal plate attached to the NBC pack and signifies the commanding officer's tank. This is reinforced by the tank's name of KOJAK after the bald hero of the 1970s New York detective TV series and a reference to the lack of hair of the commanding officer of the Irish Hussars – Lieutenant-Colonel Richard S. Webster. The tank displays the registration number 02EB86 to front and rear as well as the Union Flag. On the lower rear hull plate is a night convoy distance marker of alternating black and white stripes. The Chieftain is shown on a firing range to calibrate the coaxial machine gun and ranging gun so the green flag indicates that none of the weapons is loaded with live ammunition.

for the crew. Many Allied tank designs suffered from this fault but the M4 Sherman was more prone than most to ammunition fires, particularly the petrol-engined variants used by the British. It was a lesson they took to heart and the design of the Centurion ensured that all main armament rounds were stowed below the level of the turret ring, where they were less likely to be ignited if the turret was penetrated.

This method was continued in the Centurion's successor but, because of the bagged-charge concept, more efficient and safer stowage of ammunition was possible. To allay the fears of ammunition fires further, the bagged charges were stowed below the turret ring in water jackets which, if penetrated by red hot fragments, doused the



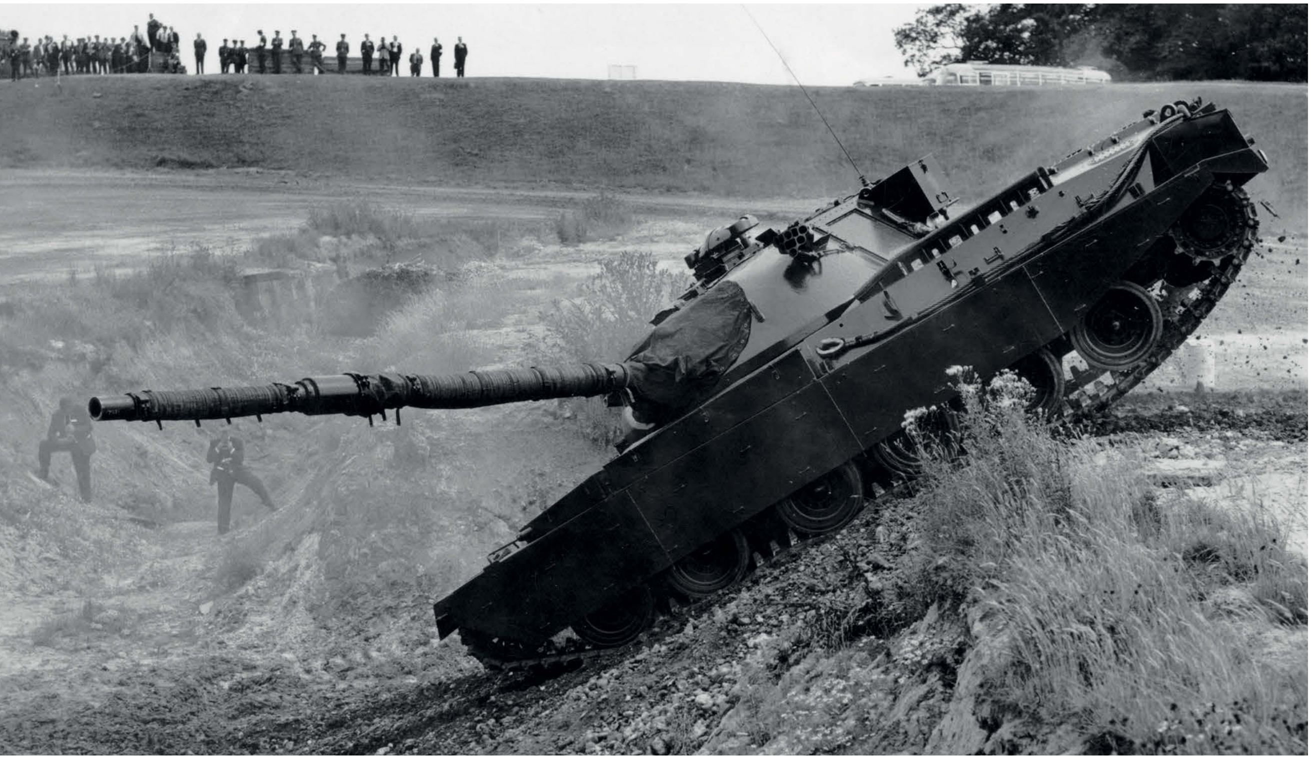
The Chieftain was Britain's first true Main Battle Tank or MBT. It superseded both of the former classes of tanks represented by the Centurion Medium Tank and the Conqueror Heavy Tank which were a legacy of the World War II policy of two distinct types of tanks, designated Cruiser and Infantry, for different types of armoured operation. With its powerful 120mm main armament and well-sloped heavy armour, Chieftain was the most formidable MBT in the NATO alliance for many years.

bagged charge in a water/glycol mixture that either precluded or delayed ignition of the cordite charges. The nature of two-piece ammunition allowed AP rounds (which have no explosive content) to be stowed around the walls of the turret and in outside stowage bins for rapid replenishment on the battlefield while all propellant charges and HE projectiles were stowed in the hull. Consequently, although the use of two-piece ammunition has been proven to enhance crew safety, its main advantage was more efficient stowage and therefore more rounds carried for a given calibre of main armament. Despite the much larger calibre, the Chieftain Mark 5 was able to carry 64 120mm rounds as against 65 20-pdr (83.4mm) of the Centurion Mark 5.

The development of the bagged charge concept with a gun of 105mm calibre began in 1954. At this time, the Study Concept Programme was investigating numerous innovative design avenues, including AFVs armed with guided missiles or a combination weapon firing free-flight rockets and a low velocity gun (later to come to fruition in the form of the 152mm Shillelagh weapon system of the M551 Sheridan); a fixed gun vehicle with a variable suspension (later to see fruition as the Swedish Strv.103 S-Tank); a tank with an oscillating turret and automatic loading system (later to become the French AMX-13); coupled vehicles with the automotive train in the front section and the fighting compartment in the rear (later to see fruition as the All-Terrain Vehicle Bandvagn Bv. 206) and small air-portable one- and two-man tanks. One such design was the FV4401 Project Prodigal armed with externally mounted twin 120mm recoilless rifles fed by rotary magazines each holding seven rounds of HESH ammunition. The General Staff was much concerned during the 1950s with the concept of strategic air-portability to move troops and equipment by aircraft to meet the commitments of a far-flung empire embroiled in minor wars and insurrections. In the event, Project Prodigal never saw the light of day but the idea later emerged in the guise of the CVR(T) – Combat Vehicle Reconnaissance (Tracked) – family of air-portable AFVs such as the Scorpion, Scimitar, Striker, Spartan, Samson and Samaritan.

Notwithstanding this requirement for air-portability, in 1954 the General Staff reiterated its belief in a conventional four-man tank with a fully rotating turret, but with a greater gun/armour combination than that of the Centurion to counter the preponderance of Soviet heavy tanks massed along the Inner German Border. This requirement was concurrently being addressed by the development of the FV214 Conqueror Heavy Tank, which was the last vestige of the Universal Tank programme that had been initiated in 1946. The Conqueror was scheduled to enter service in 1956, but only in limited numbers, with manufacture to cease in 1957 after the production of some 200 models. Its purpose was to bolster the Centurion armoured regiments with long-range firepower thanks to its US-designed 120mm main armament and sophisticated fire control system. The Centurion was still armed with the 20-pdr gun. By now, it was provided with highly effective APDS ammunition, but even so the tank was likely to become obsolete before long.

In the meantime, the British and Americans had identified the requirement for a tank gun capable of defeating 120mm of rolled homogenous steel armour with an inclination of 60 degrees at a range of 2,000 yards. A joint assessment by ARDE and FVRDE was completed by April 1956 and recommended a 120mm main armament with bagged charge ammunition. Two months later, the concept was embodied in a vehicle with a new Rolls-Royce 90-degree V8 engine, incorporating an auxiliary engine in the Vee, and an automatic gearbox. Beside the bagged charge concept, its most radical feature was to have the driver in a reclining position when closed down; by this means the vehicle height could be reduced and therefore overall vehicle weight, which was estimated to be approximately 47 tons, kept under control. It was still hoped that this could be reduced by two tons during development to meet the original General Staff weight requirement.



A Chieftain prototype goes through its paces during the first demonstration before the Secretary for Defence John Profumo and the press on 7 August 1963 at the Fighting Vehicles Research and Development Establishment at Chertsey in Surrey.

At this time Leyland Motors was appointed as the main design contractor for the new tank that was now designated FV4201 instead of Medium Gun Tank No.2. The company was heavily committed to the development of the improved models of the Centurion, the Mark 7 and 8, which had priority to meet the requirements of the British Army and overseas customers. As the overall concept of FV4201 had not been finalised as yet, detailed design work was limited to the suspension units, which were to be similar to those of Centurion but suitable for a tank weighing 45 tons. Other suspension systems were considered, such as hydro-gas and torsion bars, but were rejected as the former was too complex and the latter increased vehicle height to an unacceptable degree. Meanwhile, three vehicles were produced to prove the feasibility of the driver's reclining position and the new turret without an external mantlet for the main armament. Based essentially on existing Centurion components, they were designated FV4202 but were known as the '40-ton Centurion', although they weighed nearer 42 tons once completed.

There now followed a short hiatus in the development process as Britain and America tried to incorporate interchangeable assemblies in their respective tank designs. The US Army did not concur with the British findings for a 120mm main armament and preferred a smoothbore gun of 90mm calibre in a tank classified as T-95 although a sister vehicle, the T-96, armed with a 105mm rifled gun was also under development. Like FV4201, the T-95/96 was to weigh 45 tons. In the event, the British were not persuaded by the perceived advantages of the smoothbore weapon and the Americans never took to the bagged charge concept. Nevertheless, much time and effort was expended to make the turrets of FV4201 and T-95 interchangeable on the respective hulls, although to what purpose remains a mystery.

By now, the hull design of FV4201 was well advanced and married to the new suspension units. Various configurations for the vital frontal area of the hull were considered, mainly based on Soviet designs. At first a complex sloping of welded plates similar to the IS-3 was tried but then it was decided to take a step backwards. When the British took over their sector of Berlin after the Soviet occupation in 1945, they found no items of any military significance until one collapsed apartment block was cleared to reveal an IS-2 heavy tank. Instead of welded plates, it featured a cast hull front with well-sloped armour and this was copied for FV4201. Similarly, the turret front of FV4201 was a massive casting which was welded together, with the roof and the rear turret section of rolled plate armour.

The design of the turret had also undergone alteration following a revised User Requirement in November 1957 for an increase in gun elevation and depression from plus 15 degrees and minus 7.5 degrees to plus 20 and minus 10 respectively. This necessitated a larger turret, which inevitably meant an increase in weight, which was compounded by a new User Requirement for infra-red (IR) night-fighting and vision equipment with a 22in searchlight/IR projector in an armoured housing on the side of the turret. Furthermore, the Army now demanded an increase in armour thickness on both the turret frontal aspect and glacis plate. Experience in Korea had shown that tanks needed greater protection against strikes from medium artillery shells. Although these did not necessarily penetrate the tank's armour, they could cause weld seams to fail with consequent damage to the interior, so monolithic cast sections for the hull and turret were preferred. By now the weight of FV4201 was rising inexorably but worse was to come.

In late 1957 the standardization committee in NATO determined that all fighting vehicles within the alliance should be powered by engines capable of running on a wide variety of fuels from standard diesel or kerosene to petrol or domestic heating oil. This

A line of Chieftains Mark 2 of the 4th/7th Royal Dragoon Guards prepares to move off during a training exercise at Soltau in West Germany in 1969. The main identifying difference from the Mark 1 is the new contra-rotating commander's No.15 Mark 1 cupola with its single-piece hatch.

decision was to have far reaching consequences for FV4201. The 'multi-fuel policy' had obvious attractions whereby, at the flick of a switch in the driving compartment, military vehicles could refuel from various facilities across Europe be it from a commercial petrol station or an apartment block oil storage tank. In January 1958, to conform with this policy, it was decided to install a new engine for FV4201 and a German compression-ignition, opposed-piston design derived from a Junkers Jumo aviation engine of World War II vintage was chosen for further development as a multi-fuel tank power-plant. Not only did this cause a further delay in the FV4201 development cycle because the engine compartment had to be completely redesigned, it also added a further ton to the weight – which was now estimated to be nearing 50 tons.

The compact two-stroke, vertically-opposed piston layout was deemed to be best suited to the multi-fuel requirement because it had fewer moving parts for greater reliability and would be easier to service and have good cold starting characteristics – a significant consideration when operating on the North German Plains in the depths of winter. It is curious that an aviation engine designed for operating in the cold environment of high altitude should be considered suitable for installation in the armoured envelope of a tank engine compartment. Designated the L60, development of the multi-fuel engine proceeded during 1958 at Leyland Motors and a single cylinder test-bed model was running by the end of the year. From the outset, the Royal Armoured Corps held severe reservations about the L60 engine but the politicians and their civilian scientific advisers brushed these aside. It proved to be a costly decision. Britain's NATO partners quickly realized that the multi-fuel concept was impracticable and abandoned the idea. Each of the tank-producing countries adopted standard diesel engines that proved reliable and effective. Only the British continued to pursue the multi-fuel concept with an unsuitable engine until it was too late. Ironically, the L60 engine never ran on any other fuel than diesel.

The General Staff issued a consolidated and detailed guide of the characteristics it required for FV4201 on 21 August 1958. In essence, this demanded a tank that combined the firepower of the Conqueror with the mobility of the Centurion and an armour configuration that provided the maximum protection within a weight limit that remained at 45 tons. An increase in top speed to 26mph was also required with a range of 300 miles at a constant 15mph, reflecting the need for greater dispersion on the nuclear battlefield. In the same month, Vickers-Armstrong at Newcastle-upon-Tyne became the main contractor for the design of the turret and for installation of the weapons. Meanwhile, development of the L60 engine continued at Leyland Motors and Rootes Limited. Concurrently, Self-Changing Gears Limited was tasked with the design of the gearbox for FV4201 and the TN12 semi-automatic 'hot-shift' transmission was adopted, based on the TN10 transmission that had originally been developed for the abandoned FV300 light

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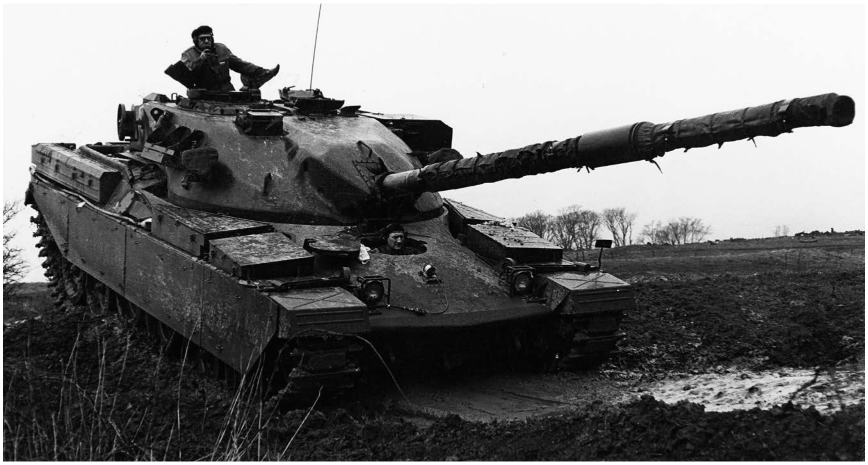


RIGHT Production of the Chieftain Mark 1 began in May 1963 at ROF Barnbow and at Vickers-Armstrong at Elswick in Newcastle upon Tyne, despite continuing problems with the L60 engine and TN12 gearbox. Forty examples of the Mark 1 were built but with an engine output of just 585bhp they were mainly used for trials and training, as here, with extra instrumentation on the glacis plate for the driver. The Chieftain Mark 1 can be identified by the split hatches on the commander's No.11 cupola, similar to those on late marks of Centurion.

tank series. The first TN12 transmission was completed and subjected to dynamometer tests in March 1959.

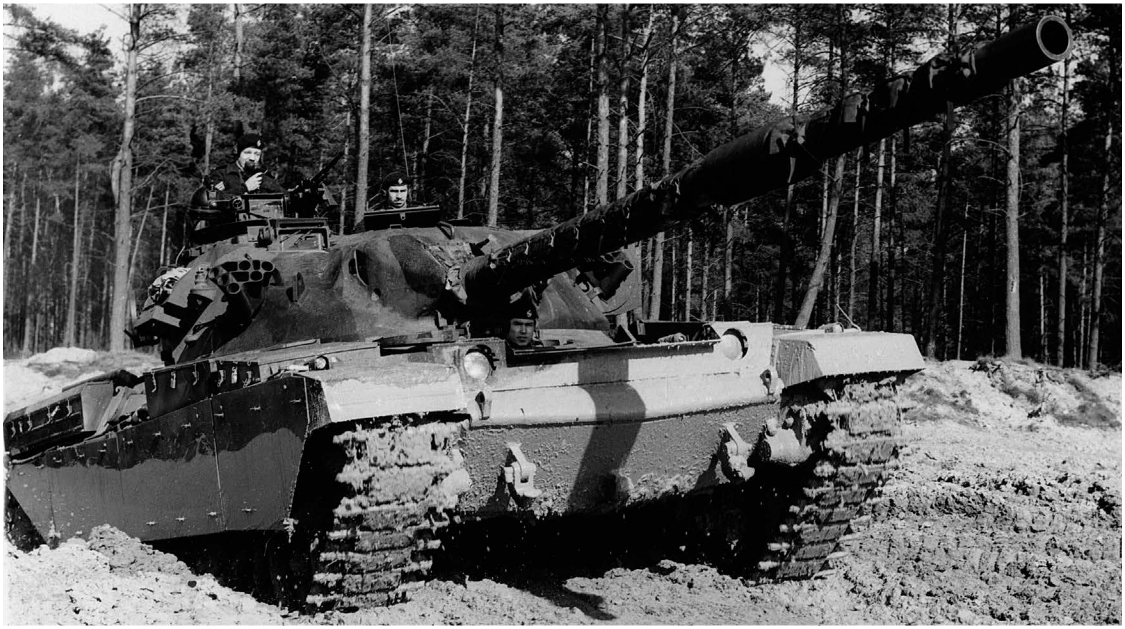
In the same month, a meeting was convened at FVRDE Chertsey to accept the design of the wooden mock-up of FV4201. Its vital statistics comprised a height of 7ft 10in, a hull length of 22ft 3in, and a ground clearance of 17in. The tank was to carry 60 rounds of ammunition and 250 Imperial gallons of fuel, with an engine developing 700bhp at a crankshaft speed of 2,400rpm giving a power-to-weight ratio of 15.5bhp per ton. Overall weight was calculated to be 100,000lb, or 44.6 tons. The design was accepted in principle but, as always, further modifications and alterations were requested causing further delays although the production of six prototypes (P1–P6) was authorized. In June 1959, six further prototypes of FV4201 (W1–W6) were ordered for troop trials with manufacture shared between Vickers-Armstrongs and the Royal Ordnance Factory at Leeds. A further two vehicles were to be built for trials by West Germany following a bilateral agreement to test each country's tanks; Britain received two Leopard 1s for assessment. In September, the TN12 gearbox successfully completed its initial trials and was married with the first low-powered version of the L60 engine in a test rig hull. They were subjected to a limited amount of running at Leyland Motors prior to the rig's appearance at the Director of the Royal Armoured Corps conference in December. Prototype P1 was delivered to FVRDE in January 1960 with P2 in April. Both of these were purely automotive models with a circular superstructure in place of the turret, known as the 'Windsor Turret' because of its similarity in shape to the Round Tower at Windsor Castle.

Running trials began in earnest during the early part of 1960, but only on roads and with the engine speed governed to 1,800rpm. Attempts to run the engine on a variety of fuels proved extremely problematical and REME craftsmen of 5MAG (Maintenance Assessment Group) discovered that it would take at least eight hours to modify the feed system for different fuels, an obvious impossibility in the field under combat conditions. The multi-fuel concept was fatally flawed from the outset but the die was cast and FV4201 was now lumbered with an engine whose performance was woefully inadequate and giving cause for grave concern. Many failures occurred due to excessive engine vibration and in the gear train between the top and bottom crankshafts. Problems were also encountered with overheating of the gearbox and the hydraulic fan drives. In time, these problems were ameliorated by various measures, such as reducing the crankshaft speed to 2,100rpm from the intended 2,400rpm and moving the exhaust silencers into an armoured box attached to the rear hull. All these modifications added to the overall weight of the vehicle, which had now risen to almost 50 tons. This in turn meant that the suspension units, which had originally been designed for a vehicle weighing 45 tons, had to be strengthened causing yet another increase in weight, as did the decision to fit rubber pads to the tracks to conform with German requirements to limit the damage to roads during exercises by the BAOR. With an engine output of just 500bhp, this gave a power-to-weight ratio of only 10bhp per ton or less than two thirds of the General Staff requirement.

The continual stoppages in the development cycle due to engine and other failures meant that it was impossible to test fully all the other components. For instance, by October 1960 only three gearboxes had completed more than 500 miles with very little cross-country running, which is when the transmission is really put to the test with multiple gearshifts at different loads. Over the next year, as the first new engines with increased power of 550bhp appeared, problems with the gearbox became apparent, particularly with the electrical control solenoids and the input shafts. These problems with the transmission would have been discovered much earlier had it not been for the troubles with the L60 engine that greatly limited the length of automotive trials. Accordingly, there was no time to permit a proper redesign of the problematic assemblies, as it was only possible to take ad hoc interim measures in order to keep the prototypes running and the development cycle in train. This did not augur well for the future.

While Prototypes P1 and P2 continued their difficult testing regime, P3 was delivered to RARDE Chertsey in April 1960 where trials of the gun control equipment were undertaken. For his task of target acquisition the commander was provided with a x10 binocular periscope, while the gunner had a x8 monocular sight linked to the main armament in both azimuth and elevation with an optical link between the two sights. The range to target was established ballistically by a .50-calibre ranging gun mounted parallel to the main armament. Although a hydraulic gun control system for turret traverse and gun elevation, as favoured by the Americans

OPPOSITE When the Chieftain first entered service, it suffered recurring gearbox failures. In the early 1970s, the Chieftain was bedevilled by serious engine problems that were a constant source of breakdowns in the field. The situation became so bad that all Chieftains were taken off the road leaving the British Army's contribution to NATO severely compromised. Following the implementation of the Sundance programme, reliability improved but the target engine life of 4,000 miles was rarely realized. For years the L60 was prone to producing clouds of exhaust plumes that were readily visible on the battlefield. The two-stroke engine also had a very distinctive sound that was audible over long distances that was a further tactical liability. A new starting technique introduced in 1983 ensured better lubrication of the upper crankshaft, which significantly increased the durability of the engine. By the time of the introduction of Challenger, Chieftain availability was in the order of 80 per cent and considerably better than its successor. During the Gulf War in 1991, the Chieftain special purpose variants of the Royal Engineers and REME achieved the remarkable Mean Distance Between Failures of 3,792km; well over twice that of Challenger.



A Chieftain Mark 2 of 3rd Royal Tank Regiment churns through the mud during the spring thaw at Fallingbostel in West Germany in April 1962. Above the main armament is the coaxial L8A2 7.62mm machine gun and at the commander's cupola is the L37A2 7.62mm machine gun. On each side of the turret is a No. 9 discharger that is capable of firing six grenades at once to create an instant smoke screen and mask the tank from enemy observation as it seeks cover among trees or dead ground. Like the first Chieftain model, the Mark 2 has two jerrycan holders on the right-hand side of the turret.

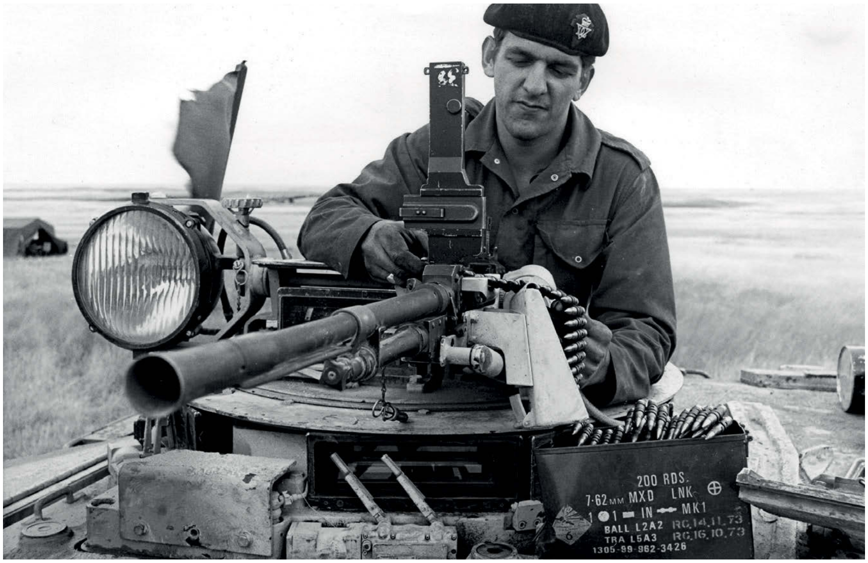
and Germans, was considered, an improved version of the tried and tested electro-mechanical equipment, as used on the Centurion, was adopted for FV4201 despite its greater bulk and slower reaction time, because British authorities considered high pressure hydraulic lines to be too dangerous inside the turret.

Firing trials by FVRDE of the L11 120mm gun mounted in W3 began in May 1961 at the Kirkcudbright gunnery ranges in Scotland and later in the year by the RAC at Lulworth in Dorset. Despite serious reservations with the commander's cupola and its machine-gun mounting, these proved highly satisfactory, in complete contrast to those devoted to the tank's automotive performance. Inevitably, there were a number of defects, not least of which was the necessity to replace the original M85 ranging gun with the M2 Browning. The ranging gun system was always seen as an interim measure pending the introduction of a fully integrated laser rangefinder then under development. Firing three-round bursts of tracer ammunition that ignited on striking a hard target, the ranging gun had to be precisely aligned with the main armament to be of use. Once correctly sighted, it was a simple, cost-efficient and robust system that had the advantage of automatically factoring in such variables as trunnion tilt and crosswinds, but in the early days was only effective out to a range of 1,500 yards – which rather negated the long-range capability of the 120mm main armament. Prototypes P3 and P4 also conducted firing trials at Kirkcudbright, including the IR night-fighting equipment, during 1962.

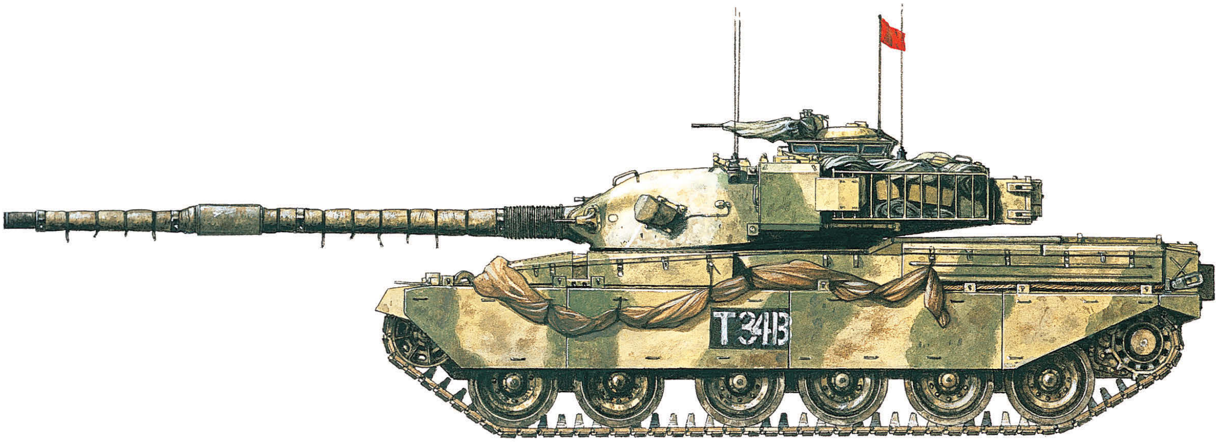
Throughout this period, the prototype vehicles were constantly being modified or reworked to the latest standards. They were then sent on different trials with either FVRDE or service personnel. By now, it was decided to despatch two FV4201 vehicles, now named Chieftain, to BAOR for troop trials with operational units in the field. The two units concerned were the 1st and 5th Royal Tank Regiments (RTR), stationed at Hohne and Fallingbostel respectively. During 1962 selected crews were sent from Germany to FVRDE, Bovington and Lulworth for initial familiarization and training. In late December W1 and W3 arrived in Germany under conditions of great secrecy with one going to each regiment. The trials were to last three months.

First impressions were good. In the harsh winter conditions the rubber track pads of the Chieftain were a considerable aid to mobility on the icy roads compared to the steel tracks of the Centurion, which skidded and slid with gay abandon. However, the same wintry conditions soon revealed the worst aspect of Chieftain as far as its crews were concerned – which was to be an issue throughout its career – the lack of an internal heater, the victim of one of the perennial weight-saving measures. Furthermore, when the spring thaw came, the Centurion was better able to negotiate the muddy conditions than the Chieftain due to the latter's low ground clearance of 17in. This was subsequently raised to 22in by substituting Centurion road wheels and modifying the suspension, but with an overall increase of vehicle height of just an inch. Automotively, the tanks performed adequately although there were several gearbox failures and its limited power output meant it had only comparable cross-country mobility to the Centurion Mark 7 against which it was paired for trials purposes.

As to gunnery, various deficiencies became apparent, not least of which was the workload for the loader/radio operator who had to maintain and serve three weapons and the radios as well as providing the crew with hot drinks and meals from the BV ('boiling vessel') mounted behind the main armament. But worst of all was an electro-mechanical device for ramming the projectile into the breech that was totally unreliable and a real hazard to the loader himself. The RTR 'tankies' quickly devised an alternative means to seat the projectile by using the Combustible Cartridge Case (CCC) itself as a rammer. Despite official disapproval, this became the standard method of loading. The complex electro-mechanical device was discarded and was not fitted to production vehicles. The culmination of the trials was a 72-hour 'closed-down' exercise whereby a 5 RTR crew manned a Chieftain for a three-day period without opening any hatches at all while a reserve crew refuelled and serviced the vehicle from the outside. Each day, the tank had to undertake at least ten hours of motoring over all manner of terrain, while all equipment such as radios and gun stabilizer were operating, in order to test everything fully. The exercise ended with a comprehensive shoot on Hohne Range 7A with all ammunition being expended in an orgy of destruction before an audience of high-ranking officers and RAC personnel.



A Chieftain tank commander of 5th Royal Inniskilling Dragoon Guards loads the cupola mounted L37 General Purpose Machine Gun during an exercise on Salisbury Plain. The weapon was capable of being fired from under armour against battlefield targets but was of little use against fast-moving aircraft except as prophylactic fire.



CHIEFTAIN MARK 2(Y) C, 5TH ROYAL INNISKILLING DRAGOON GUARDS BATTLEGROUP, EXERCISE MEDICINE MAN, BATUS, CANADA, JULY 1978

The British Army training facility at Suffield in Alberta, Canada, stretches over 2,500 square kilometres of rolling prairie. The vast open spaces allow the firing of virtually all the weapons systems within the all-arms battlegroup. The battlegroups of each deployment codenamed Medicine Man are either mechanized infantry or armour dominated and this particular Chieftain is employed by the 5th Royal Inniskilling Dragoon Guards Battlegroup. The tank is finished in the characteristic BATUS camouflage scheme of green and sand yellow stripes. To front and rear it bears the registration number 05EB71 in white letters and numerals on a black rectangular background with that on the rear displayed on the right-hand trackguard as viewed and that on the front lower hull offset to the right as viewed. The zap code Tango Three Four Bravo is painted on the side plates. The white stripe on the forward face of the turret is an indicator to the tank commander of his safe arcs of fire. On the left front trackguard as viewed is stencilled 2ND ARMD SQN (signifying Second Armoured Squadron) and on the right-hand one 1/78 which is a date stamp to indicate when the vehicle was last overhauled. The red flag is flown when the tank's weapons are loaded with live ammunition.

Although generally successful, the trials demonstrated that there were still many faults to be rectified before series production could begin. Despite the demands of many in the high command who wished for the new MBT as soon as possible, further development, particularly of the engine and transmission, was necessary. Nevertheless, the Chieftain was accepted for service on 1 May 1963 to allow production to start, but over the next two years only an extra 35bhp could be squeezed out of the L60 engine before it equipped the Chieftain Mark 1 of which 40 were built – in fact there was one pre-production model and 39 to the Mark 1 specification. Deliveries were made between mid-1965 and early 1966 with 26 being manufactured by the Royal Ordnance Factory (ROF) Leeds and 14 by Vickers-Armstrong. In the event, the Mark 1 was only used for troop trials and training; one of the first Chieftains to arrive at the School of Electrical and Mechanical Engineers (SEME) Bordon was so underpowered that it was incapable of climbing onto a tank transporter. The first proper Chieftain model, the Mark 2, was delivered to the British Army from ROF Leeds on 18 April 1966. The first armoured regiment to be equipped with the new MBT was the 11th Hussars (Prince Albert's Own) – The Cherrypickers – which received its first six Chieftains in November 1966.

The next major variant, the Chieftain Mark 3, first rolled off the production line at ROF Leeds on 16 September 1969. It featured an improved L60 Mark 5A engine of 650bhp and many other enhancements. Even so, the Chieftain remained underpowered for a tank now weighing 53 tons and even more worryingly the L60 engine was increasingly plagued with problems of reliability. It was apparent that the attempts to increase engine output had resulted in the reduced reliability. Furthermore,

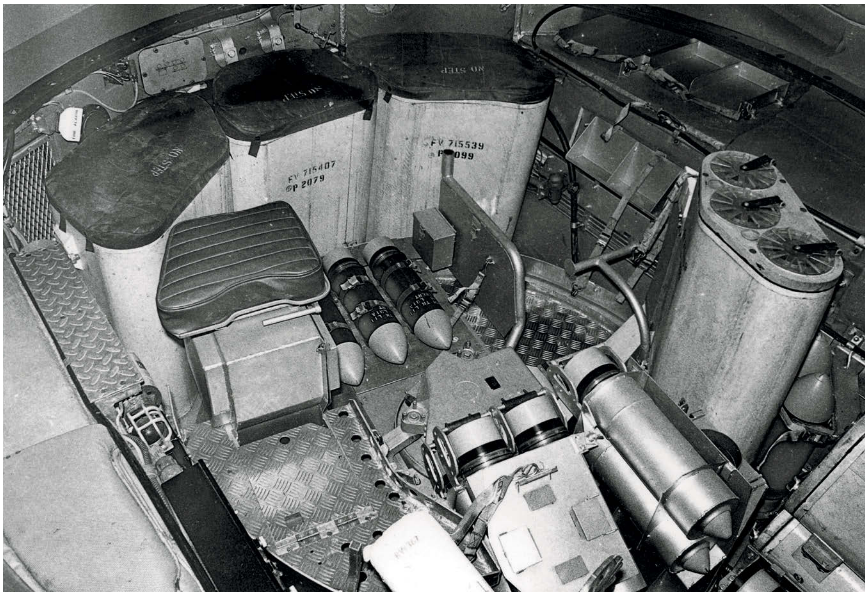
In the 1970s the Chieftain was plagued by engine reliability problems. In a parliamentary investigative report published on 23 May 1978, the House of Commons Technical Affairs Sub-Committee concluded: 'The performance of the Chieftain's gun and range-finding equipment is first class. It is therefore all the more unsatisfactory that the tank should have been let down by its engine in the past.' The problems of the L60 engine were exacerbated by the inadequate provision of spare parts and replacement powerplants. Nevertheless, when Chieftains were used on a regular basis, such as those at BATUS in Canada, they proved to be much more reliable than average. These Chieftains are undergoing routine maintenance at the BATUS workshops prior to an exercise on the Canadian prairie in 1979.

whenever one problem was partially solved, another component within the power train began to suffer repeated breakages. There were four main aspects of engine failure: cracking of the cylinder liners; failure of the cylinder lip seals; piston fire ring breakages; and cracking of the rear gear cases. All these problems were eventually resolved but not before Chieftain's reputation had been irredeemably compromised. The first engine modification programme was known as Totem Pole and was combined with other improvements to upgrade all previous marks of Chieftain to the same standard as the final production vehicle for the British Army, the Mark 5. This version subsequently incorporated the L60 Mark 8A engine of 750bhp at 2,250rpm giving a top speed of 30mph with a road range of 310 miles. The Mark 5 was the definitive Chieftain model. It weighed 54.8 tons which was almost ten tons greater than the original General Staff requirement, an increase of almost 25 per cent.

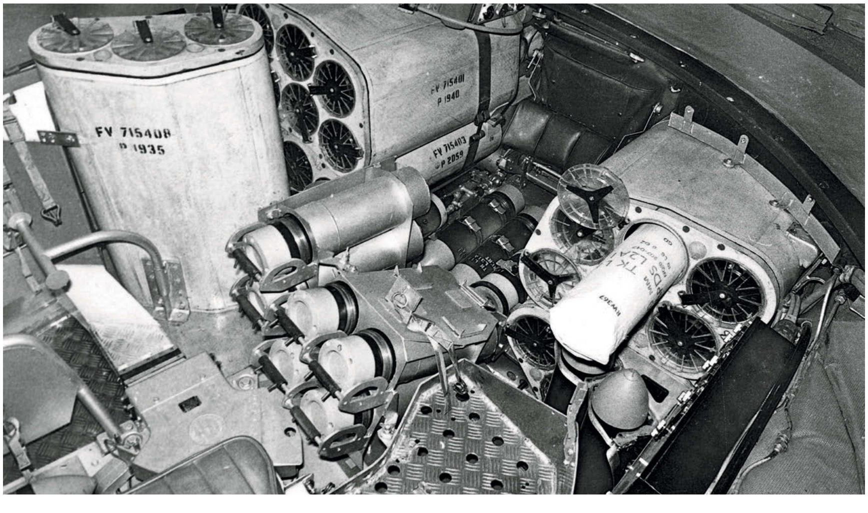
The problems of engine reliability became so bad that an investigation was undertaken by the Expenditure Committee and the Defence and External Affairs Sub-Committee of the House of Commons and their findings were published in 1978 – (The Chieftain Tank Engine – HMSO London 23 May 1978). Its conclusions were damning – "The performance of the Chieftain's gun and range-finding equipment is first class. It is therefore all the more unsatisfactory that the tank should have been let down by its engine in the past. It is difficult to feel confident about the future performance of the engine in the light of the subsequently unfulfilled assurances given by the Ministry of Defence… We wish to assure the House that the present programme of engine modifications, as it has been explained and demonstrated to us, appears to be meeting with success so far… Nevertheless, despite these welcome improvements, we cannot avoid observing in conclusion that the saga of the Chieftain tank is not one which reflects well on the Ministry of Defence, even allowing for an element of sheer bad luck in the problems which have dogged the engine. It is only right to point out, moreover, that, assuming the present programme of modifications represents the final instalment, it will be well over halfway through the Chieftain's active life before it has an engine to match its other undoubted assets."

TECHNICAL DESCRIPTION: CHIEFTAIN MARK 5

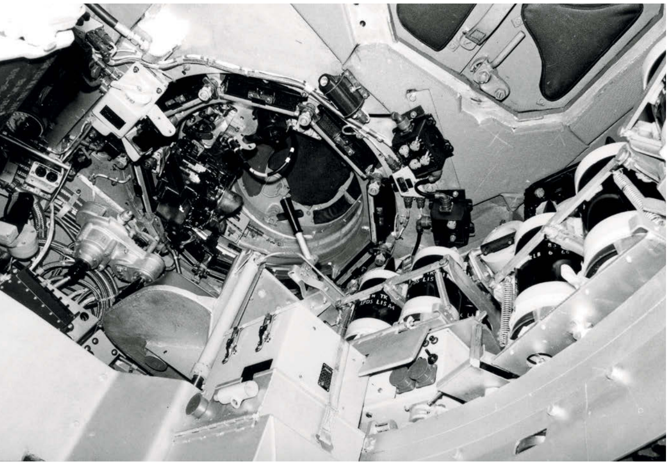
The design of any tank is essentially a compromise between three fundamental but mutually conflicting factors – firepower, mobility and protection. The key function of a tank is to defeat enemy armour so heavy firepower is the primary requirement for the designer. But the heavier the weapon, the larger the turret must be to house it and its associated ammunition, which in turn requires a larger hull to accommodate it.

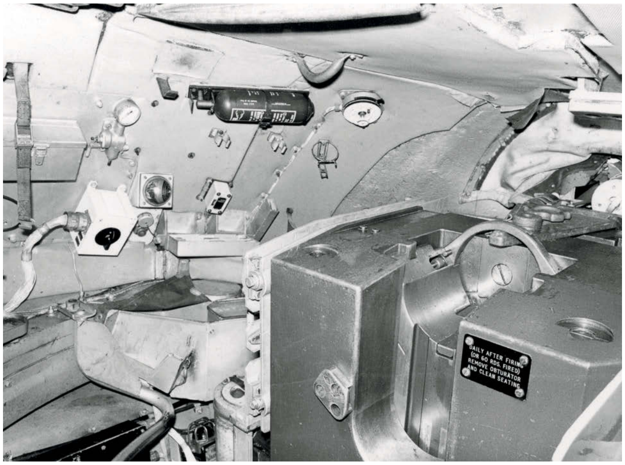


TOP RIGHT This series of photographs depicts the interior of a late production model Chieftain Mark 5 produced for foreign military sales. A view from the gunner's position looking backwards with the commander's seat at left with charge bins behind and HESH rounds stowed on the floor and beneath the main armament – all these explosive rounds are stowed below the level of the turret ring for greater survivability.



BELOW RIGHT A view looking forwards and downwards from the commander's position with charge bins to each side of the driver's seat.





TOP LEFT A view from the loader's position looking up to the commander's cupola. In the centre is the BV or boiling vessel beloved of all British tank crews for brewing tea and cooking combat rations.

ABOVE A view of the loader's position looking over the massive breech of the L11 120mm main armament.

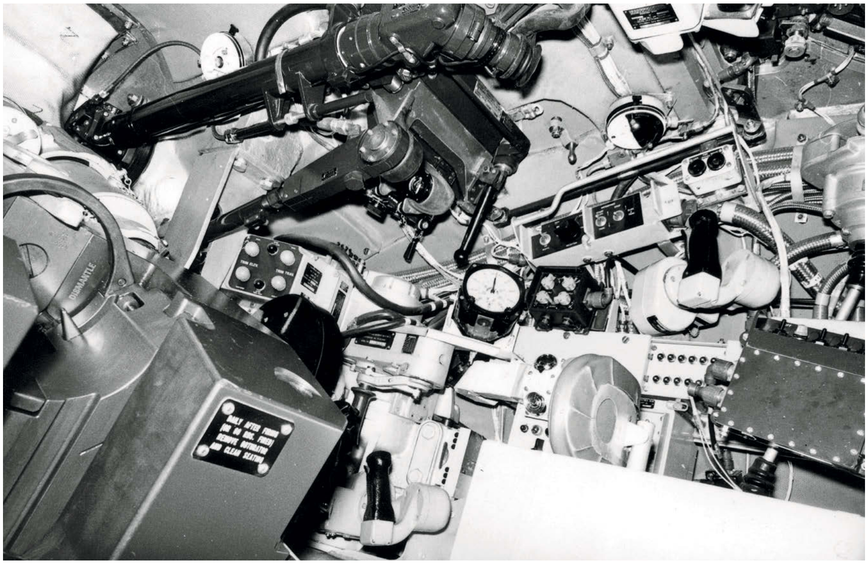
The larger the hull and turret, the heavier they must be if they are to incorporate adequate armour protection but armour is very heavy and thus added armour requires an engine of much greater horsepower to achieve adequate mobility. The greater the horsepower, the larger the engine but this in turn requires a larger hull to house the bigger engine which means more weight and so it goes on inexorably.

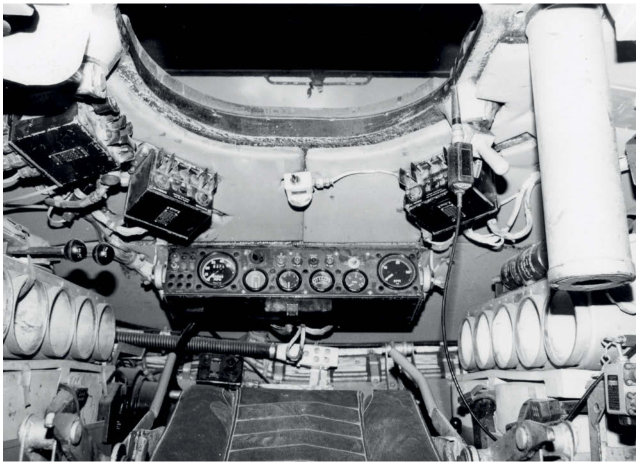
Although many innovative concepts were addressed at the outset, the Chieftain emerged as a conventional design with a four-man crew and a fully-rotating turret housing the main armament on a hull divided between the driver's compartment at the front, a central fighting compartment, and the engine, gearbox and cooling assemblies at the rear that delivered power to the rear-mounted drive sprocket and propelled the fully tracked vehicle.

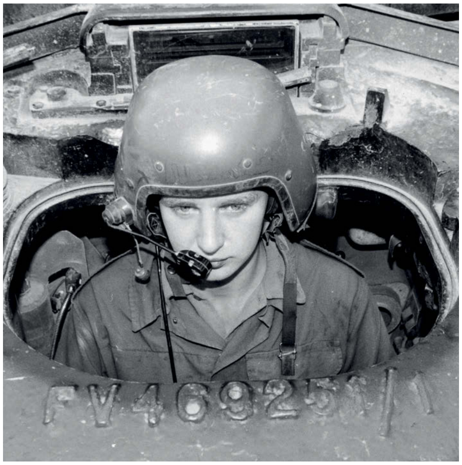
The driver is located centrally in the front hull with ammunition charge bins and batteries on each side. His seat can be reclined for driving when closed down. This also allows him a means to escape into the fighting compartment in an emergency, as well as providing a comfortable bed at night. The driver controls the vehicle by means of two steering levers located on each side of his seat; by pulling the right-hand lever, the vehicle turns to the right and so on. Above his position is a single-piece 'lift and swing' hatch to allow entry and egress at all points of turret traverse. Behind the driver's hatch is a single wide-angle AFV No.36 Mark 1 periscope that can be replaced by an IR or passive night sight. To his front is the main instrument panel below which are three foot pedals with from right to left the accelerator, brake and the gearbox controller, which works on the same principle as a motorcycle gearshift whereby 'toeing' the lever upwards engages a higher gear ratio and toeing down a lower. The selected gear ratio also determines the radius of turn with the lower the gear, the tighter the turn for manoeuvring in confined areas. The driver has two switchboards, for the GUE or Generating Unit Engine and the main engine respectively. Usually referred to as the 'aux gen' or 'genny', the GUE is used to start the main engine, so saving on battery power, and to charge the batteries themselves. It also provides electrical power for the gun control equipment and BV during silent watch periods when it is tactically unsound to run the main engine.

The fighting compartment is located centrally and extends to the full width of the hull with the turret suspended on a ball race to allow 360-degree rotation. The other three crew members are housed in the turret, with the commander and gunner seated to the right of the main armament and the loader/radio operator to its left. The

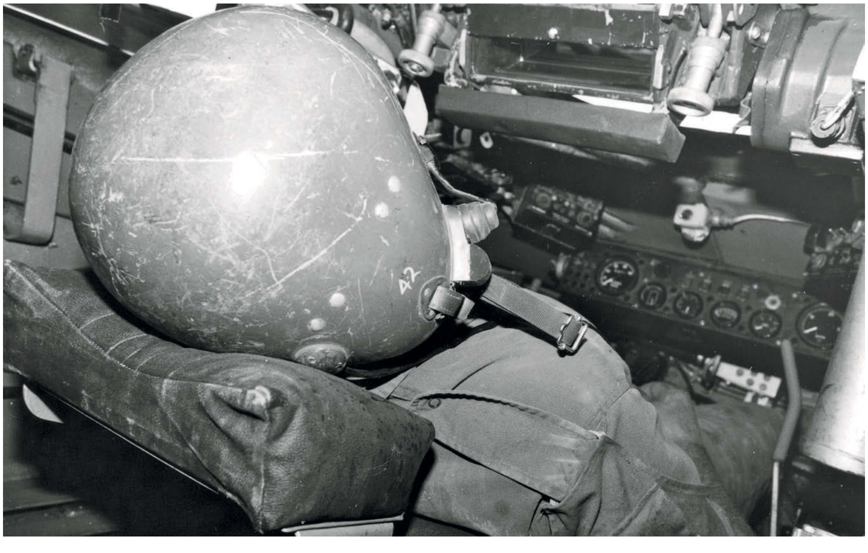
A view looking upwards from behind the breech to the gunner's position showing the fire control system.

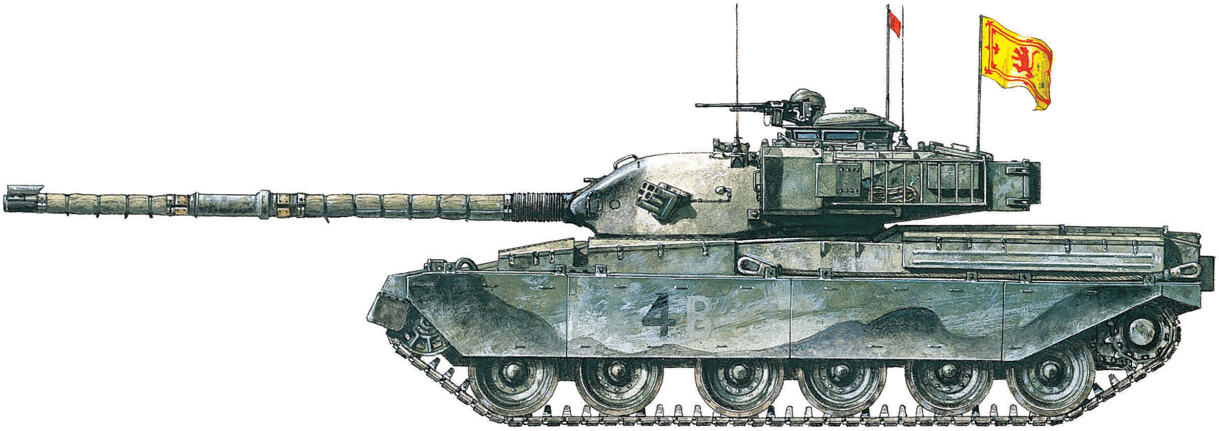






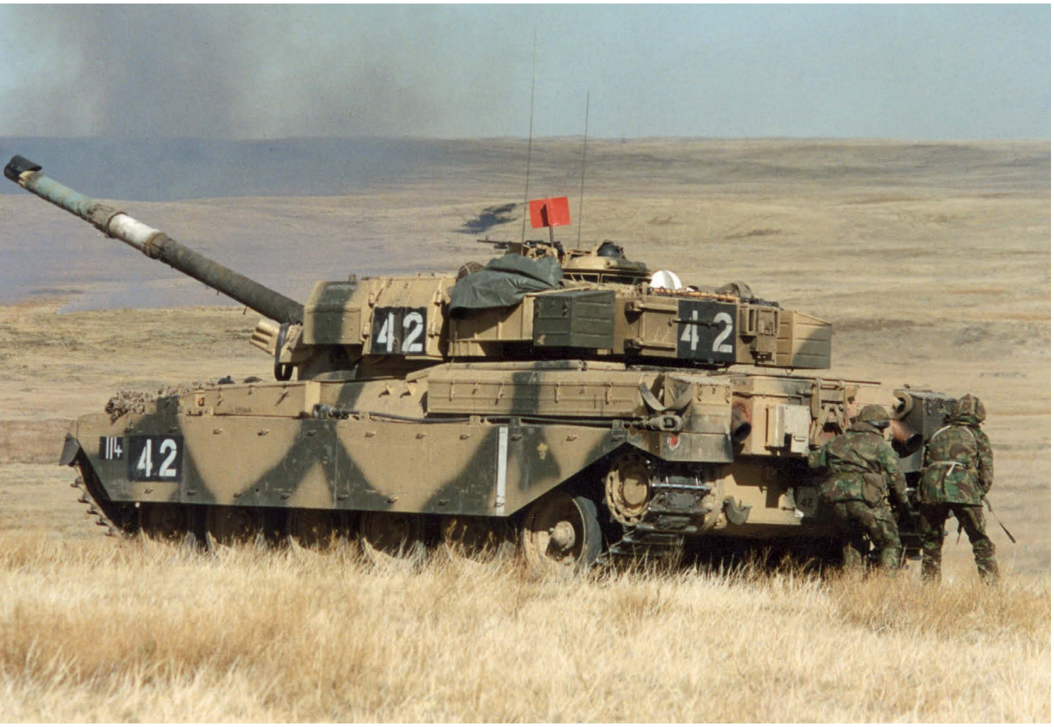
ABOVE, ABOVE RIGHT AND RIGHT One of the particular characteristics of the Chieftain was the reclining position of the driver when operating the tank closed down with the steering tillers to each side of the seat while normally he drove the tank with his head above the level of his hatch.



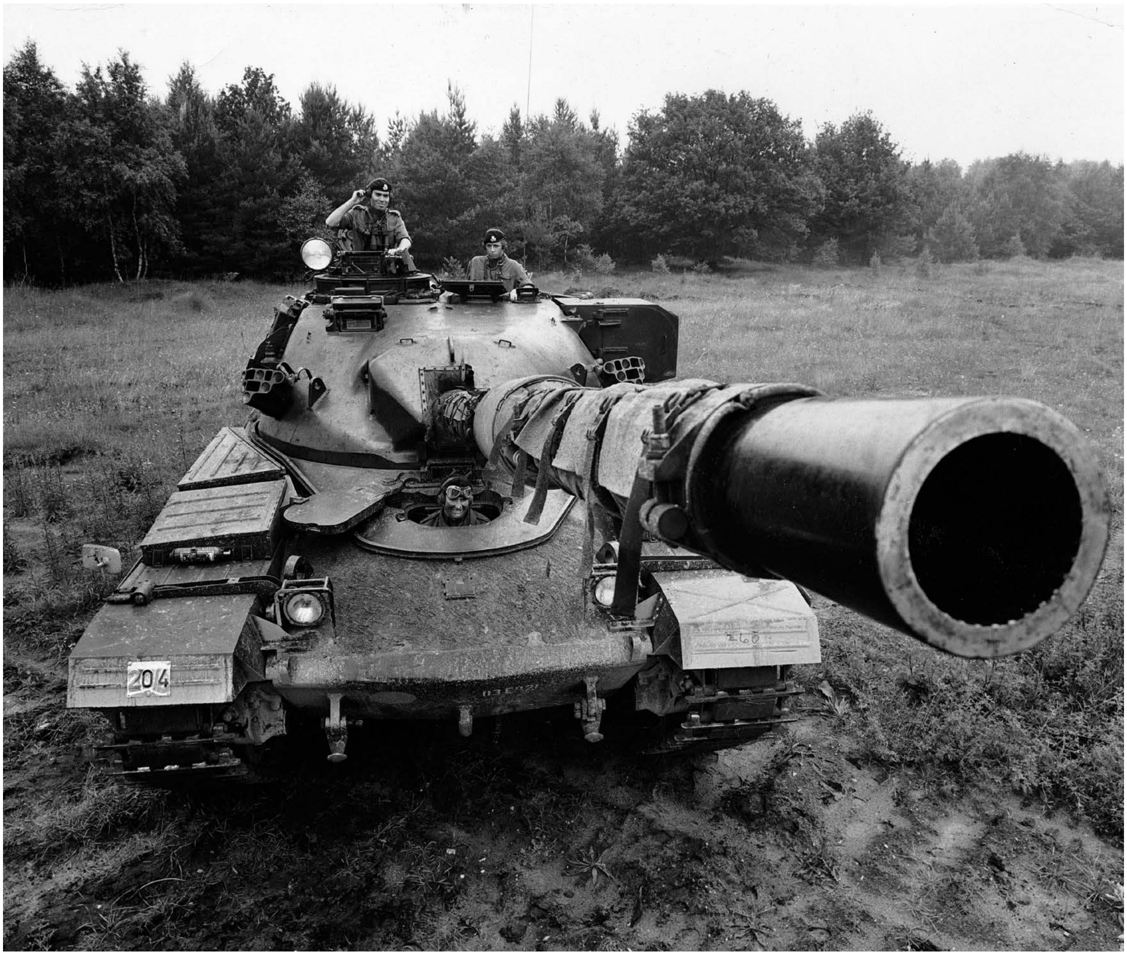


CHIEFTAIN MARK 5/3 C, 4TH TROOP, CAT SQUADRON, THE ROYAL SCOTS DRAGOON GUARDS, CANADIAN ARMY TROPHY 1983, BERGEN-HOHNE, WEST GERMANY, JUNE 1983

The Canadian Army Trophy was an annual, then biannual, tank gunnery contest within the NATO alliance of those countries with armour units in West Germany. For many years it was a highly prestigious competition with great kudos accruing to the winning team and the type of tank they crewed. The Chieftain only won the trophy once in the hands of the 16th/5th The Queen's Royal Lancers in 1970. In CAT '83, the British Army was represented by The Royal Scots Dragoon Guards, hence the Lion Rampant flag flying above this Chieftain Mark 5/3 C. This model featured the newly installed Improved Fire Control System, each costing £90,000, and great hopes were held for CAT '83 as this regiment has traditionally had a high reputation for tank gunnery within the Royal Armoured Corps. The tank carries the registration number 00FD66 to front and rear; again offset to the right on the lower front hull; offset to the left as viewed there is a subdued weight classification of a grey 56 on a solid black circle. The vehicle callsign Four Bravo is displayed on the side plates and centrally on the turret rear NBC pack with 4B painted in grey on a black square. Note the difference between the L11A5 120mm Tank Gun with the L11A2 and A3 type as shown on the previous profile with the mirror of the Muzzle Reference System mounted above the end of the barrel.



Following the loss of Libya as a training area in1969, a ready substitute was found with the British Army Training Unit Suffield on the prairies of Canada. Painted in the characteristic camouflage scheme of green and yellow of BATUS, the first Field Training Exercise known as Medicine Man was held in 1972.



In November 1966, the 11th (Prince Albert's Own) Hussars – the 'Cherrypickers' – received the first Chieftains built to the production specification. Designated Chieftain Mark 2, the tank featured a 650bhp engine (the L60 No.4 Mark5A) giving a power-to-weight ratio of 15.9bhp per ton that was among the lowest of contemporary designs. The second regiment to receive Chieftain in BAOR was the 17th/21st Lancers as here showing the L11 120mm rifled gun to good effect.

commander is provided with a No.15 Mark 2 cupola that can be traversed through 360 degrees. It provides all-round direct vision through nine AFV No.40 Mark 2 observation periscopes and a single AFV No.37 Mark 4 sighting periscope. On the exterior of the cupola is a spotlight and an L37A1 7.62mm machine gun. The gunner is seated forward of the commander and he has two primary sights, the periscopic AFV No.59 which protrudes through the roof and the direct vision AFV No.70 telescopic sight. At night both the gunner and commander can replace their daytime sights with infra-red (IR) versions. Mounted on the left-hand side of the turret is a 2kW combined white light and IR projector capable of identifying targets out to a range of 1,000m in the IR mode. The Chieftain can also be fitted with an IR detector above the roof that gives an audible and visual warning when an IR source is illuminating the tank. The loader is provided with a single rotating periscope AFV No.30 Mark 1 and a two-piece hatch in the roof.

The loader also acts as the radio operator and the basic equipment for this function initially comprised the Larkspur C42 and B47 sets with integral intercommunications for all the crew members; the Larkspur was later superseded by the Clansman range of radio equipment. As loader, he serves and maintains the main armament, the L21A1 ranging gun and the L8A1 co-axial 7.62mm machine gun by providing a constant flow of ammunition and clearing any stoppages or misfires that might occur.

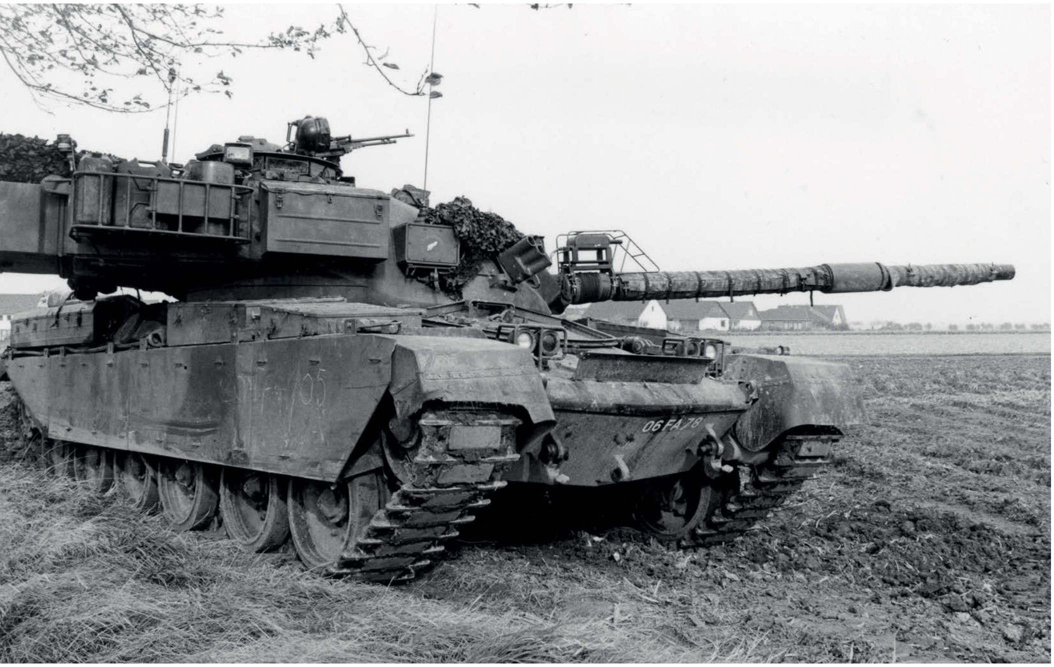
L60 MULTI-FUEL ENGINE
MANUFACTURED BY
LEYLAND MOTOR CORPORATION
ENGLAND
LEYLAND

The mark of Cain that was to bedevil Chieftain throughout its career was the Leyland L60 engine. Originally developed to run on a variety of fuels, the L60 only ever used diesel and was both underpowered and unreliable.

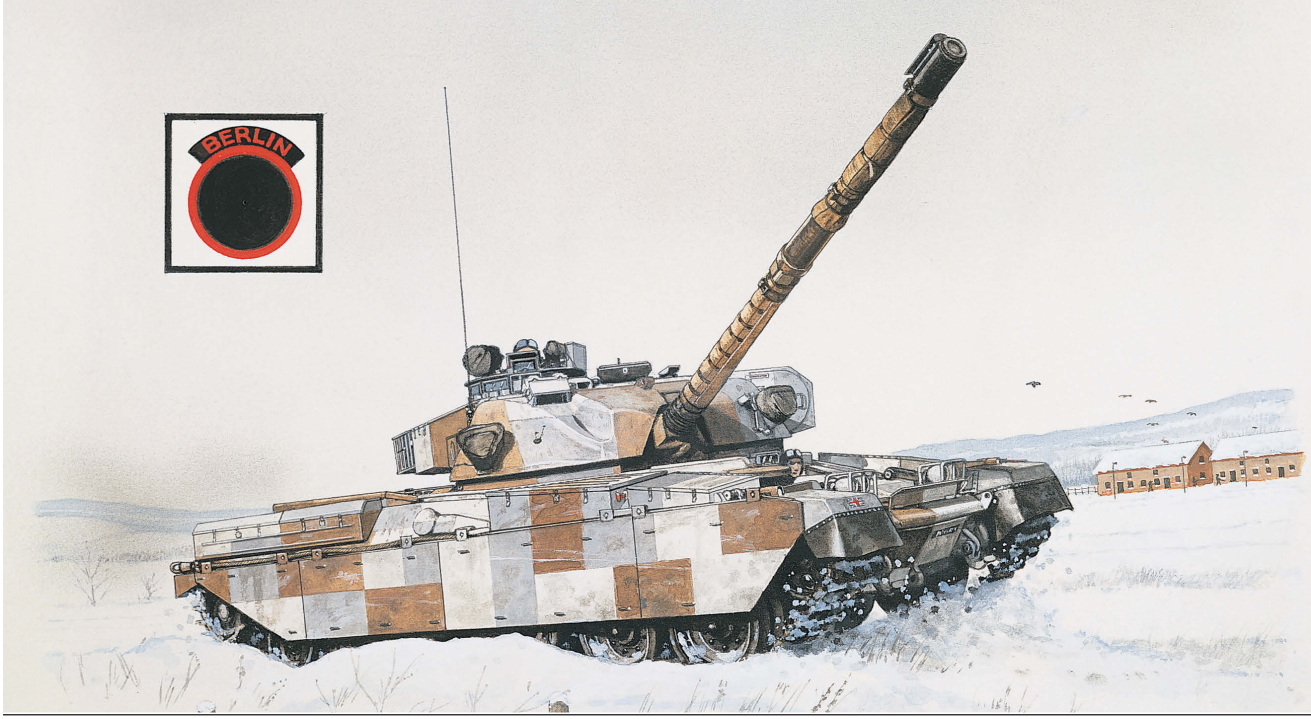
The L11 120mm high-velocity rifled tank gun is fitted with a fume extractor halfway down the barrel which is also wrapped in a thermal sleeve to minimize distortion of the tube and therefore loss of accuracy at long ranges due to differential heating or cooling. The gun has a vertically sliding breech block, which opens automatically after firing. After placing the projectile in the breech, the loader rams it home with the bagged charge and closes the breech. He then trips a safety switch and the weapon is ready to fire by means of an electrically initiated vent tube. The gunner lays the weapon on the target following directions from the vehicle commander. The Fighting Vehicle Gun Control Equipment (FVGCE) No.7 Mark 4 provides various modes of operation including full stabilization to allow accurate firing on the move.

The range to target is established by firing three-round bursts of the .50-calibre ranging gun using four predetermined graticule marks in the gunner's sight. Whichever burst strikes the target indicates which main armament graticule mark must be used to lay on the target and the gun is then fired. The ranging gun system was superseded by the Tank Laser Sight (TLS) which has an accuracy of plus 10m at its maximum operating range of 10,000m. The TLS was later integrated with the Improved Fire Control System (IFCS) to give the Chieftain the ability to exploit fully the superior firepower of the L11A2/A5 tank gun as against the L7 105mm of most of its contemporaries.

At the rear of the tank is the engine compartment housing the L60 engine, TN12 gearbox, final drives and cooling assemblies. The Chieftain Mark 5 featured the L60 Mark 7A of 720bhp and later the Mark 8A of 750bhp. The TN12 gearbox



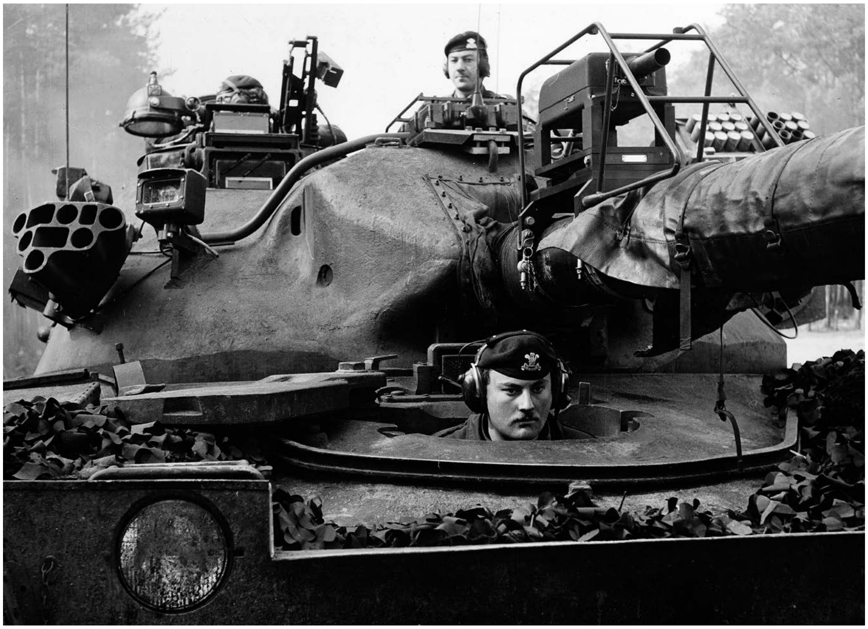
BELOW A Chieftain Mark 3 C of The Queen's Own Hussars pauses beside a tree line during Exercise Full House in West Germany during 1978. The vehicle is fitted with Simfire equipment, subsequently Simfics after the introduction of IFCS. Manufactured by the Solartron Electronic Group, Simfire and Simfics comprised: an eye-safe laser projector above the main armament; a flash/bang generator that simulated the main gun firing by sound, flash and smoke and a set of five laser pulse detectors around the turret; a data processing unit inside the tank and, on the roof, a radio link to communicate engagement data to the exercise umpires. This vehicle is also equipped with the new Clansman radio system, which can be identified by the Aerial Tuning Unit box on the side of the turret behind the smoke discharger. When fitted with Clansman radios, all Chieftain marks, from the Mark 2 onwards, were given the suffix C.

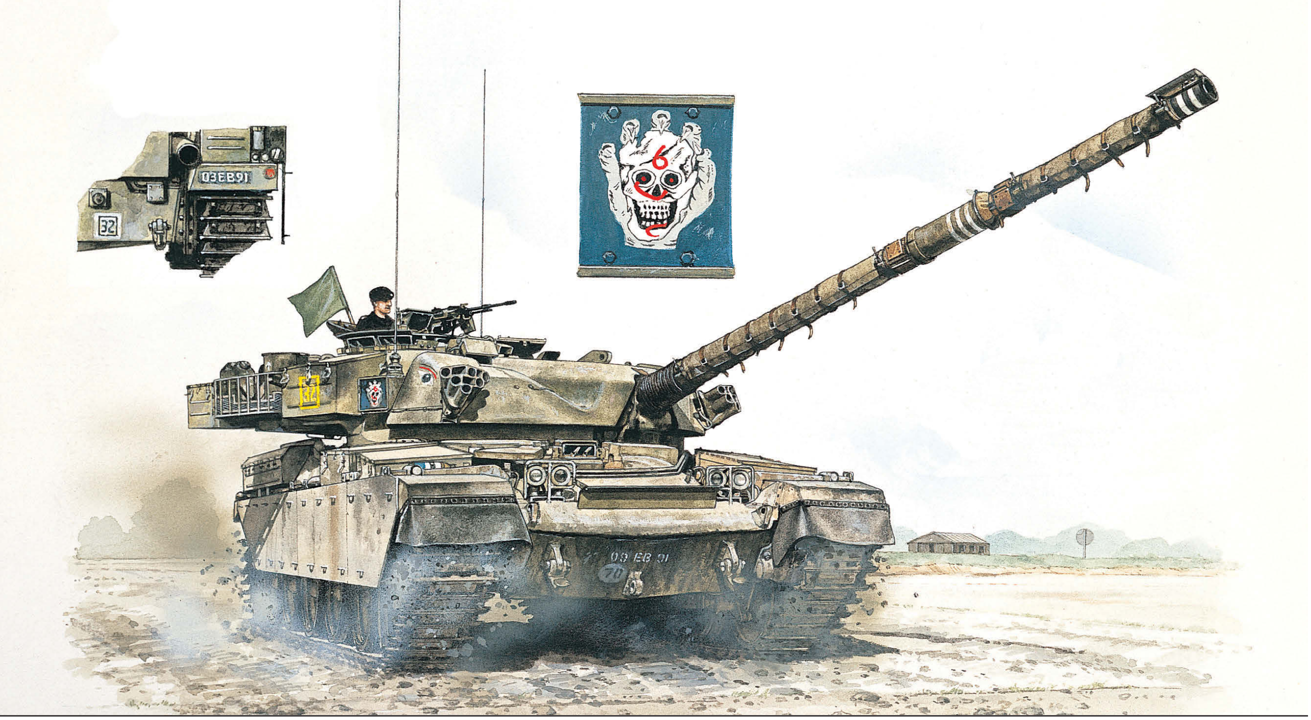


CHIEFTAIN MARK 10 C, ARMOURED SQUADRON, BERLIN BRIGADE, 1980s

Throughout the Cold War, the British Army of the Rhine stationed one reinforced infantry brigade in the former German capital of Berlin, which was occupied by the four World War II allies of Britain, France, the Soviet Union and the USA. It was common practice to attach a tank squadron to the Berlin Brigade to provide armour support to the infantry but as Berlin was deep inside the Soviet zone the brigade was only ever a hostage to fortune and in times of hostilities would have been overwhelmed in short order. During the early 1980s, Major Clendon Daukes of the 4th/7th Royal Dragoon Guards devised a radically new camouflage scheme for fighting in an urban environment. The chequerboard pattern of white, grey and brown proved more difficult to detect amongst buildings particularly from the air and it was adopted for all AFVs stationed in Berlin with the British Army. This Chieftain Mark 10 C is shown during FIBUA (Fighting In Built Up Areas) training during the depths of winter.

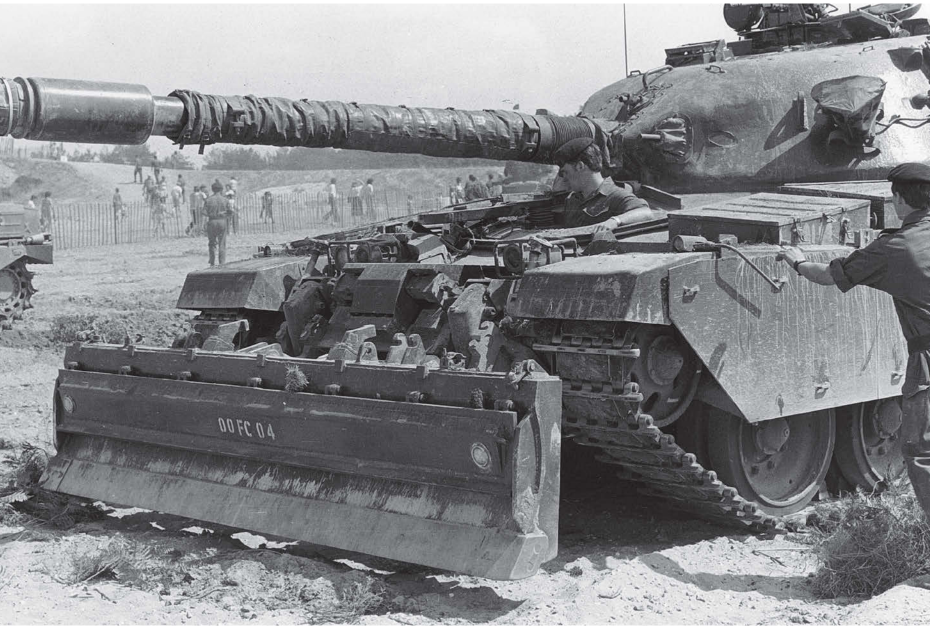
RIGHT A Chieftain Mark 2 of The Queen's Own Hussars is fitted with Simfire equipment. This system allowed much enhanced reality in tactical exercises since it recorded notional hits on other AFVs that disabled them at the umpires' discretion.



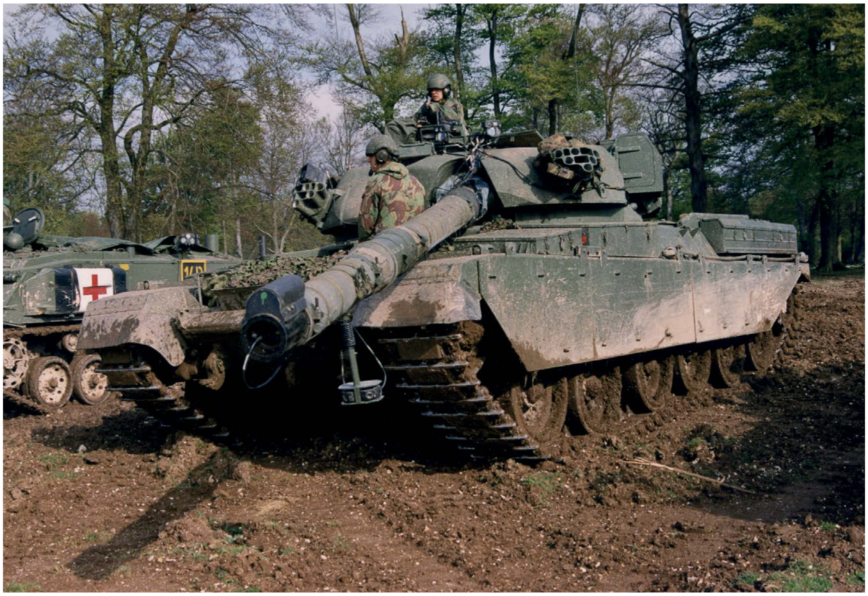


CHIEFTAIN MARK 11 C, D SQUADRON 1ST ROYAL TANK REGIMENT, CASTLEMARTIN GUNNERY RANGES, SOUTH WALES, MAY 1995

On 15 May 1995, 03EB91 fired the last main armament round by a Chieftain MBT in British Army service. The markings denote D Squadron of 1RTR (B Squadron in other RAC regiments), hence all the tanks in the squadron were named with the fourth letter of the alphabet. In this case DAKEYNE was painted in black on the side stowage bins: being named after Lt Col H.W. Dakeyne DSO, the first commanding officer of 4th Royal Tank Battalion in 1933. The vehicle callsign Three Two is displayed inside the yellow square on the side turret stowage bins indicating the troop corporal's tank of Seven Troop. The tank is also identified by the three rings on the fume extractor for Seven Troop and the two rings around the muzzle for the third tank in the troop; the troop commander's tank Three Zero having no rings around the muzzle. In 1RTR, troops are numbered sequentially; thus D Squadron has Five to Eight Troops with Seven Troop being the third troop within the squadron.



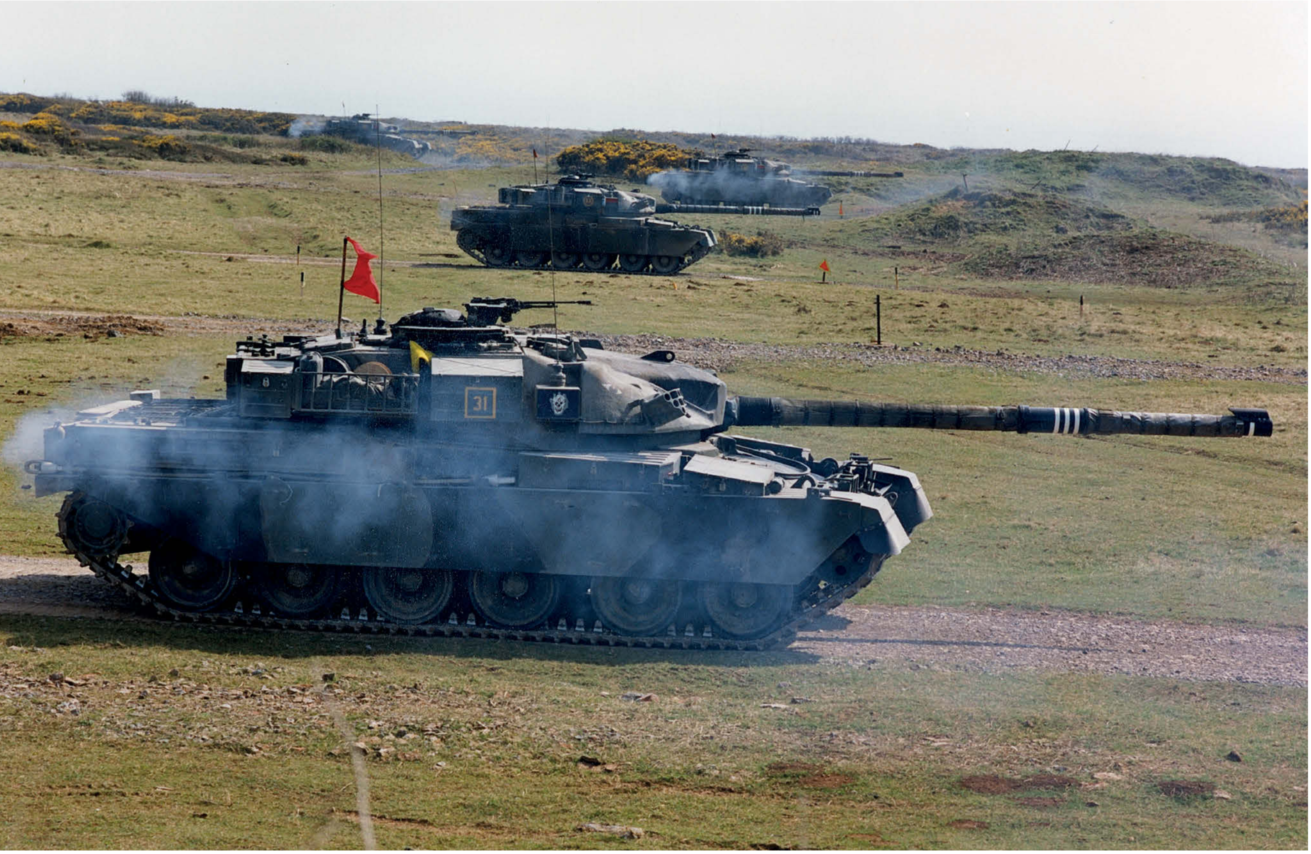
All Chieftain MBTs can be fitted with a dozer blade within six hours. Designed by Automotive Products Limited, the electrohydraulic power unit for the dozer blade is installed in place of the right-hand-front track stowage bin. A joystick unit in the driver's compartment controls the dozer blade and it has an earthmoving capacity equivalent to that of a medium bulldozer such as the Caterpillar D5. Its main tasks are the clearing or filling of obstacles on the battlefield such as anti-tank ditches and digging hull-down tank scrapes for fire positions. This Chieftain Mark 3/3 of the 17th/21st Lancers has its dozer blade lowered for use. Tank dozers were normally issued on a scale of one per squadron but the Combat Engineer Tractor subsequently assumed the role and they were discontinued.

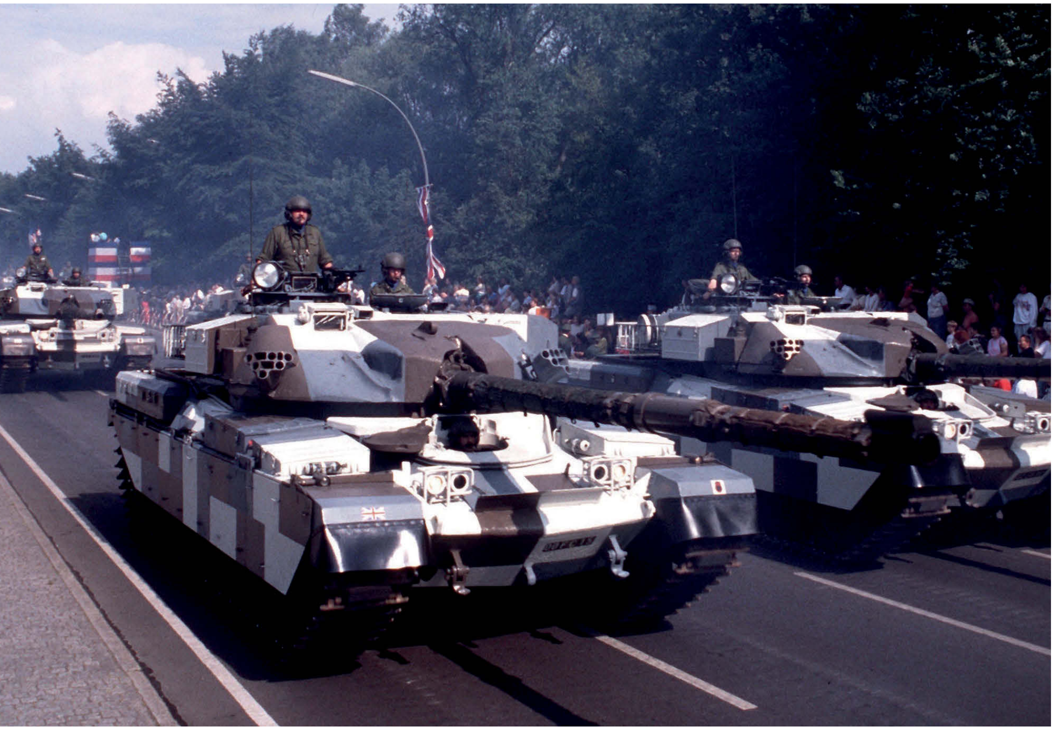


Stillbrew passive armour was developed during the 1970s at MVEE Chertsey, Stillbrew being an amalgamation from the names of the two inventors of the new armour. Although there was no formal British Army requirement for any supplementary armour for Chieftain MBT, trials showed that it gave some increase in armour protection at a modest cost with little degradation in automotive performance. In particular, it gave higher protection against hollow-charge weapons, such as the RPGs and Saggers that had caused significant Israeli tank losses during the October War of 1973. After highly successful firing and mobility trials during 1984 and 1985, Royal Ordnance Leeds began the manufacture of the appliqué armour package. It is fitted over the frontal aspect of the turret and around the driver's position to give additional protection to the turret ring. From 1986 Chieftains were fitted with Stillbrew armour in 23 REME Base Workshops at Wetter, West Germany, during base overhaul. The addition of Stillbrew and other survivability aids together with TOGS were the final major modifications to be made to the Chieftain MBT and produced the final mark of the tank. A total of 324 Chieftains were fitted with TOGS following the first delivery of the system in December 1983.

incorporates a Merritt-Wilson differential steering unit and epicyclic gear change system with six forward and two reverse gear ratios plus an emergency mechanical selector of second gear forward and low reverse. A three-cylinder Coventry Climax H30 No.4 compression-ignition auxiliary engine is also fitted in the engine compartment to provide electrical power and a facility for starting the main engine. The Horstmann suspension consists of three double bogies each side, with the drive sprocket at the rear, a front idler and three top return rollers. The tracks are of cast steel, with 96 links each when new, and each track link has a detachable rubber pad for either combat or peacetime conditions.

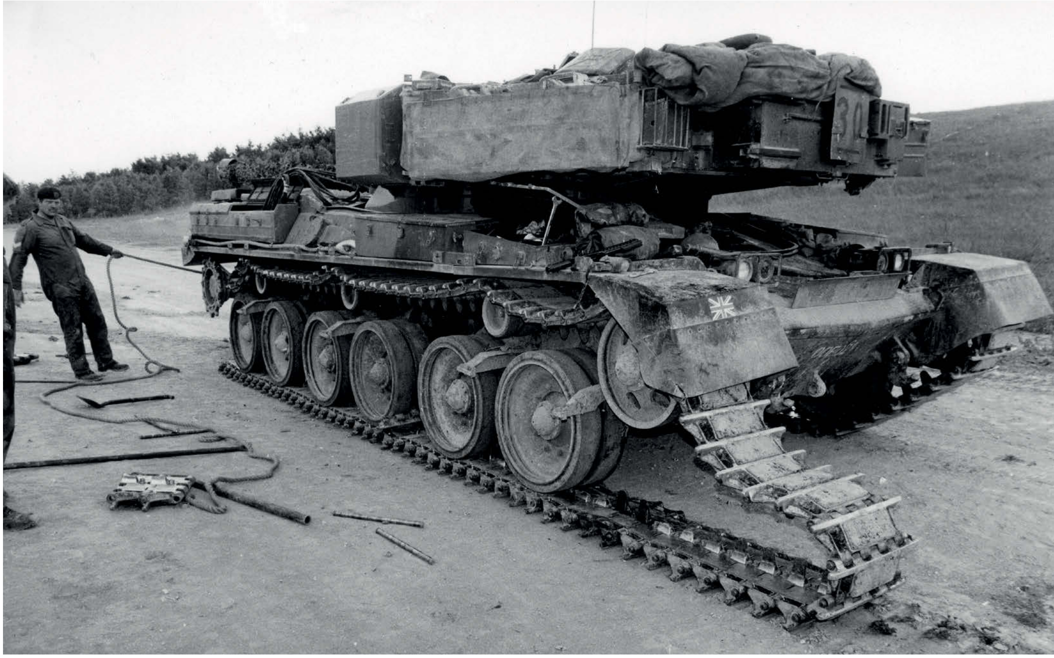
The Chieftain Mark 5 was the final production model for the British Army although there were many subsequent marks and sub-marks (see below). Almost 1,000 Chieftain MBTs were built for the British Army and an equal number for foreign armies. In 1971, the Imperial Iranian Army ordered 792 Chieftains including 707 Mark 3/3P and 5P MBTs, 71 Chieftain ARVs (fitted with Atlas cranes) and 14 AVLBs. In 1975, the Iranians ordered a further 187 improved Chieftains designated FV4030/1 with enhanced mine protection; greater fuel capacity; additional shock absorbers and an automatic gearbox to simplify driver training. However, Iranian dissatisfaction with the L60 engine led to a requirement in December 1976 for the complete tank fleet of Chieftains to be modified to accept the Rolls-Royce CV12 that was being developed for the Shir 1 and 2 FV4030 models. A design study by the Ministry of Defence Procurement Executive decided that a derated version of the CV12 of 800bhp be used to avoid significant changes to the gearbox, final drives and cooling system. On 11 July 1977, the Shah of Iran authorized the modification programme but the Iranian Revolution in 1979 brought about its cancellation. In May 1976, the Kuwaiti Army took delivery of the first of 165 Chieftain Mark 5/2K MBTs. In August 1981, the Sultan of Oman's Forces acquired 12 Chieftain Mark 7/2 C MBTs on loan from British Army stocks. These were subsequently purchased by Oman as were 15 new-build vehicles designated Qayd Al Ardh after a famous desert warrior. A total of 2,265 Chieftain MBTs were produced between 1965 and 1985 in Leeds and Newcastle.



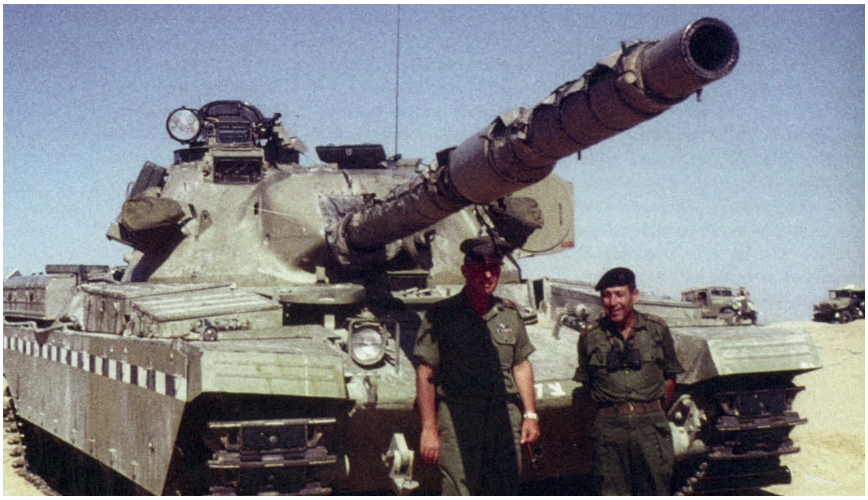


ABOVE With a red flag denoting the tank is loaded with live ammunition, Chieftains of D Squadron 1st Royal Tank Regiment wait for targets to be presented on the gunnery ranges at Castlemartin.

Resplendent in the urban camouflage scheme of the Berlin Brigade, late model Chieftains of the 14th/20th King's Hussars advance in formation during the Allied Forces Day in June 1989. Devised by Major Cedric Daukes of 4th/7th Royal Dragoon Guards, the urban camouflage scheme was adopted in the spring of 1982 and was applied to all A Vehicles of the Berlin Brigade.



The tracks and suspension of any tank require constant attention to maintain the correct track tension for optimum performance while on the move. Road wheels and suspension units need frequent lubrication while high mileage causes the tracks to stretch. Accordingly it is necessary to remove track links to allow the correct tension to be maintained: a task known to every tankie as 'trackbashing'.



Major General Israel 'Talik' Tal and IDF Chief of Staff General Yitzak Rabin stand in front of one of the four Chieftains Mark 2 tested by the Israeli Armoured Corps between 1967 and 1969. Although the Israelis wished to manufacture the Chieftain under licence, the British government eventually refused and the tanks were returned to the UK. General Tal was the leading light behind Israel's first indigenously produced MBT – the Merkava.

AND CHIEFTAIN BEGAT CHARIOT

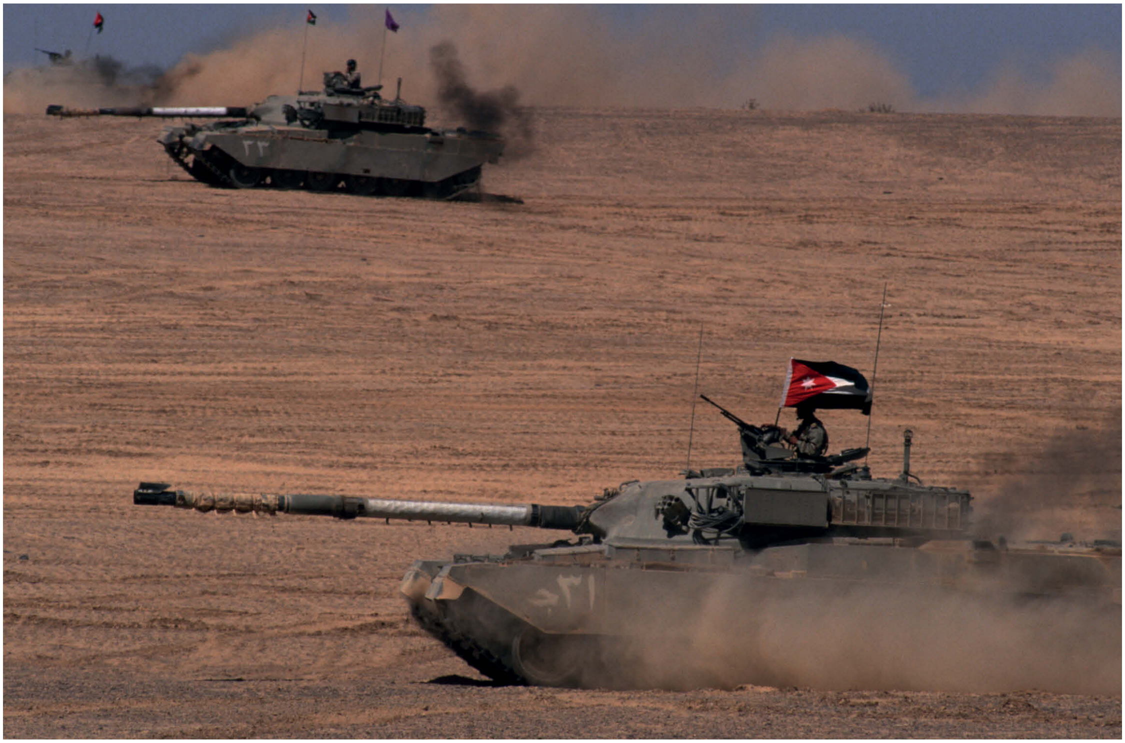
For years the Israel Defense Forces (IDF) had been obliged to acquire tanks from a wide variety of sources. As a result, the Israeli Armoured Corps was determined to produce its own battle tank, codenamed Sabra, to ensure a continuity of supply. Since France had been Israel's most reliable supplier of arms hitherto, a high-level IDF delegation visited France in early 1963 to see a presentation of the AMX-30 Char de Bataille then under development: the 30 denoting the proposed battleweight in tons. The delegation then travelled to Germany to view the German equivalent, designated Leopard after the wartime tradition of naming tanks after big cats. As head of the IDF delegation, Minister of Defence Shimon Peres (later President of

Israel) was a close friend of his German counterpart, Hans Josef Strauss. An agreement was quickly reached in June 1963 for the supply of 15 Leopards in September of that year for trials with the Ordnance Corps in Israel while a company of IDF troops would go to Germany for training on the new tank before shipment. Its codename would be Barak or 'Lightning'. However, development and production of Leopard was delayed because of budgetary constraints and other factors. Instead, the Germans agreed to provide a consignment of 150 M48A2 Pattons to the IDF. However, following a change of government in Germany only 40 were delivered for fear of offending Arab countries.

The IDF was obliged to fall back on the French option. The Israelis wished to produce the AMX-30 with the intention being to assemble the chassis locally with the turrets imported from France. By this time the Centurion was in widespread service with the IDF and the Israeli Armoured Corps, under the dynamic leadership of Major-General Israel Tal, was more inclined to the British school of tank design rather than the French belief in high mobility at the expense of armour protection. After protracted discussions, while the Foreign and Commonwealth Office (FCO) dithered for fear of offending Arab opinion, the British agreed to sell Chieftain to the IDF including setting up a production line in Israel. Initially, the tanks would be assembled in Israel from kits supplied from Britain before full production was undertaken in the country. In return, the Israelis agreed to share development costs and their experience of operating tanks in desert conditions.

Under the codename Operation Adulate, two Chieftains Mark 2 arrived in Israel for trials with the IDF in early 1967. The tanks were based at a camp at Tze'elim in the heart of the Negev Desert in the Wadi Tzin that is some 300kms long and well hidden from prying eyes. But within months the region was plunged into conflict with the outbreak of the Six Day War in June. The nervous FCO cabled Tel Aviv and demanded that the Chieftains be moved from the border regions with Egypt for fear of Arab accusations of collusion with the Israelis. The Israelis sent a laconic reply, 'Have no fears, we have moved the borders.' After extensive testing, the main engines of the two Chieftains failed after approximately 100 hours of operation and there were repeated problems with the main armament failing to return to battery when firing at maximum elevation. Furthermore, accuracy was deemed to be unacceptable at long range, as were the brakes. Following these initial trials, the Israelis suggested a host of modifications, predominantly with air cleaning and engine cooling.

Some of these were incorporated in two new Chieftains that arrived in Israel in May 1968 and the desert trials continued, providing a wealth of data on operating in hot climates. The procurement of Chieftain caused considerable interest in high places with visits to Tze'elim from several dignitaries including Prime Minister Levi Eshkol; Chief of Staff General Yitzhak Rabin and Deputy Chief of Staff Ezer Weizman. The latter caused some consternation among the British staff. When he was extolling the excellent armour of the Centurion he drew his 9mm pistol and shot the glacis plate of a Chieftain. By now the latter was called Abri or 'Knight' by the Israelis. On 17 October 1968, the Israeli government made an official request to Britain to purchase the Chieftain. On 28 October, the British government agreed to the sale of 250 Chieftains with the first 100 manufactured in Britain and the remainder in Israel. In April 1969, another Israeli delegation under General Israel Tal, arrived in Britain to study production methods at ROF Leeds and Vickers-Armstrongs.

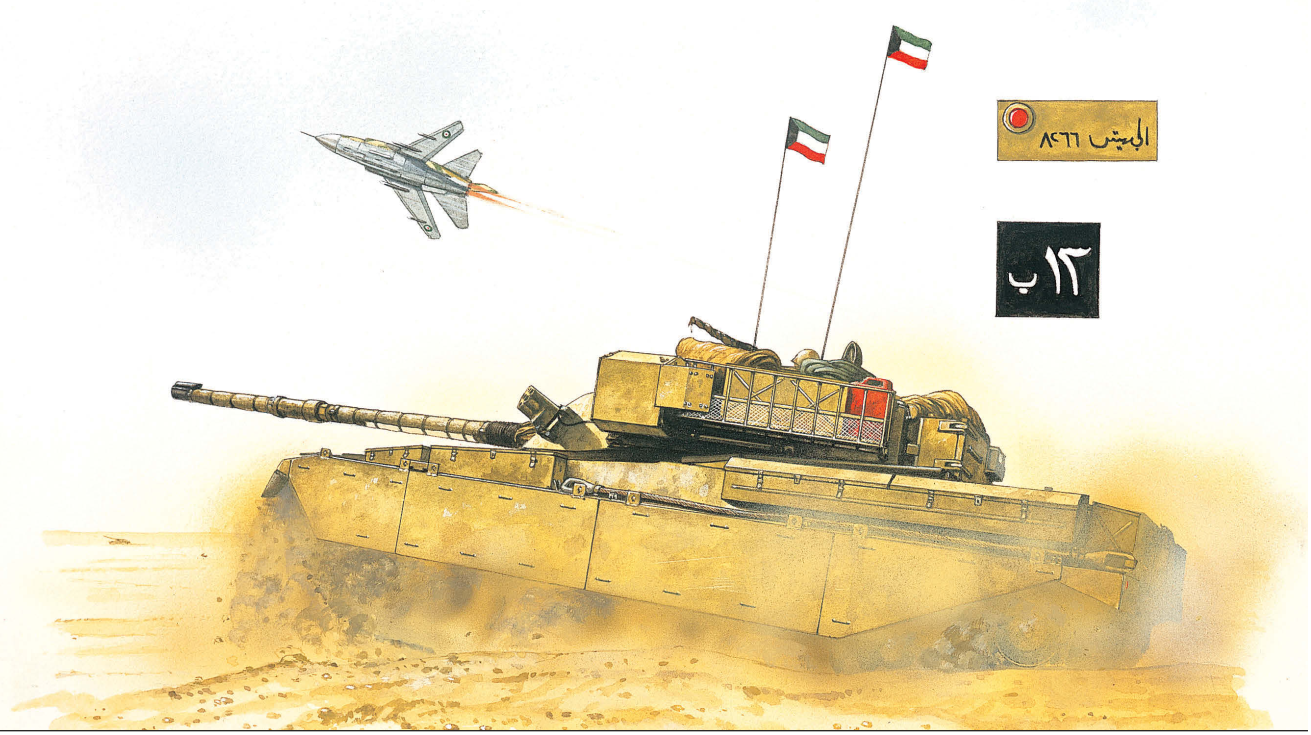


Flying the national flag, Jordanian FV4030/2 MBTs – known locally as the Khalid – of 40th Armoured Brigade take part in Exercise Infinite Moonlight in the Qatraneh region of Jordan in conjunction with the US Marines of 24th Marine Expeditionary Unit in May 1997. The Royal Hashemite Army of Jordan procured 274 Khalids from 1981 at a unit price of approximately £820,000. (Getty Images)

However, the British government was now in a quandary with the Ministry of Defence in favour of the deal and the FCO increasingly opposed to it for political reasons. One of the main reasons for denying Chieftains to Israel was an even larger order for the tank from Libya together with a highly lucrative deal for a complete air defence system for the country. Furthermore, Arab pressure to withdraw their holdings of sterling from London and the veiled threat of an oil embargo focused the minds of the FCO mandarins. The diplomats prevailed and in December 1969 Britain officially informed Israel that its request to procure Chieftain was refused. General Tal and the IDF high command was incensed with the British: all the more so because General Tal had influenced the Imperial Iranian Army to purchase Chieftain and indeed had written the complete specification for the Iranians.

The secrecy surrounding Operation Adulate continued to the end. In March 1970, the final two Chieftains were returned to Britain in the hold of an Israeli ship with the tanks masked beneath Jaffa orange boxes. Since the ship arrived at Tilbury in daylight, it was decided that the tanks were to be unloaded under the cover of darkness. The British Army reception party comprised two soldier tank drivers, the tank transporter crews and a major who shall remain nameless. He and his two soldiers retired to a pub but by the time the Chieftains were unloaded they were taken with drink. It fell to the IDF officers of the handover team to load the Chieftains on to the tank transporters. Nevertheless, the British learnt a considerable amount from the Israeli trials and incorporated numerous improvements into production and export models of Chieftain.

The duplicity of the 'Perfidious Albion' prompted General Tal and the IDF to initiate the development of an indigenous Israeli tank that emerged as the Merkava



CHIEFTAIN MARK 5/2K, 35 ARMOURED BRIGADE, KUWAITI ARMY, SAUDI ARABIA, AUGUST 1990

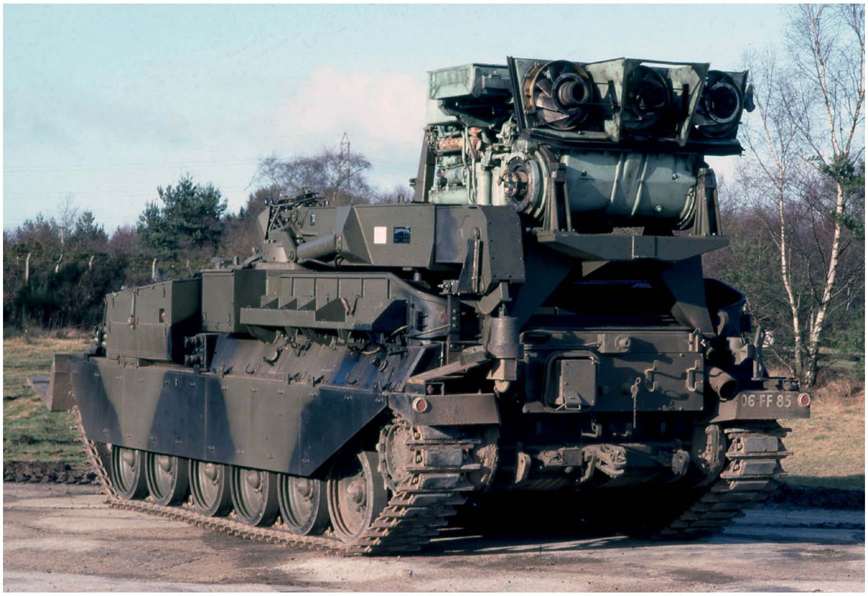
On 12 June 1961, Kuwait declared its independence but within weeks, the country was threatened with invasion from neighbouring Iraq. The British promptly despatched the Centurions of C Squadron 3rd Carabiniers from Aden to patrol the disputed border and the crisis was averted. In gratitude, the Kuwaiti Army purchased 50 Centurion tanks and subsequently 165 Chieftains designated Mark 5/2K. Following the Iraqi invasion of 2 August 1990, approximately 50 Chieftains of the 35 Armoured Brigade withdrew towards Saudi Arabia and 18 made it across the border. These were then refurbished and, together with newly procured M84 MBTs from Yugoslavia (a version of the Soviet T-72 made under licence), equipped the Al Shahid or Martyrs Brigade during the liberation of Kuwait in February 1991. Flying the Kuwaiti flag from its radio antennae, this Chieftain Mark 5/2K is depicted crossing the border into Saudi Arabia. Its only markings are the registration number on the rear left trackguard as viewed: 8466 and the inscription 'The Army' in Arabic script. This is repeated on the front left trackguard as viewed and on the opposite trackguard is the formation sign of a small yellow over blue rectangle divided diagonally from bottom left to top right A companion vehicle displayed a callsign board as shown in the scrap view that denotes Tank B 13. All Kuwaiti Chieftains carried the standard British Army night convoy distance marker of alternating black and white stripes on the lower rear hull plate.

or 'Chariot'. Its design was heavily influenced by experience with Centurion and Chieftain. The former had performed with distinction during the October War of 1973 and vindicated the British reliance on heavy armour protection, which became paramount in Merkava. Despite his antipathy towards the British government, General Tal allowed the British military attaché in Tel Aviv to inspect a Merkava prototype in 1975. Armed with a tiny notebook and pencil, Colonel Laurence New was able to glean much useful intelligence about the revolutionary design. Once production began in earnest, an official high-level British delegation visited the Tel HaShomer Merkava factory. General Tal was asked 'How do you have such a sophisticated armaments industry?'

'All thanks to Your Majesty.'

'How come?'

'Because you wouldn't sell us Chieftains.'

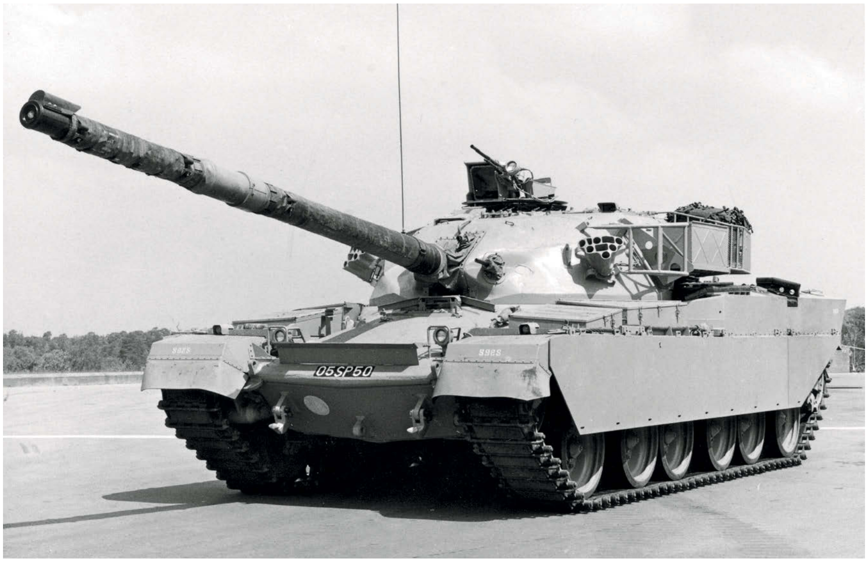


Given the chronic unreliability of the L60 engine, the Imperial Iranian Army demanded an Armoured Recovery Vehicle with an integral crane to facilitate powerpack changes in the field. With the imminent entry into service of the Shir Iran MBTs, the ARV was required to transport both the L60 and CV12 powerpacks. In this guise, the vehicle was redesignated as an Armoured Recovery and Repair Vehicle or ARRV.

CHIEFTAIN IN COMBAT

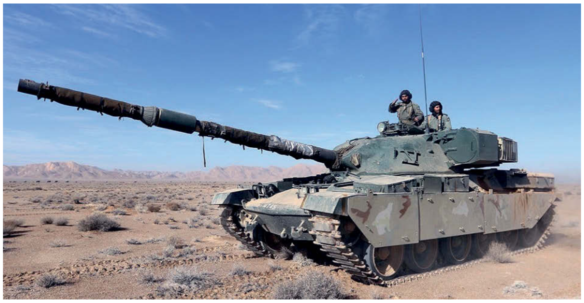
IRAN-IRAQ WAR

The Chieftain first saw combat during the tragic and futile Iran-Iraq War of 1980–88. The Iranians were mostly armed with Western tanks. In January 1971, the Shah of Iran had ordered 707 Chieftain MBTs. Of these, there were 73 Mark 3/3P and 634 Mark 5/1P as well as 41 ARVs and 14 AVLBs: the P suffix standing for Persia. A further order was made in 1975 for 193 of an improved Chieftain designated Mark 5/3P of which 185 were delivered before the overthrow of the Shah by the Islamic revolution of January 1979. At this time, the Chieftain was the principal main battle tank of the Iranian 88th and 92nd Armoured Divisions. Over the same period, the Iranians



Following its original purchases of Chieftain, the Imperial Iranian Army ordered 1,225 of an improved model originally called Shir Iran or Lion of Persia. Designated FV4030 by the British, the Shir featured a 1,200bhp Rolls-Royce powerpack and a revolutionary new form of protection called Chobham armour that had recently been developed at MVEE. Pending full development of this MBT, an interim model known as FV4030/2 or Shir 1 was produced. This was based on the Chieftain but with a new rear hull and suspension layout to accommodate the new Rolls-Royce power pack. Three prototypes were completed by January 1977 and series production of 125 Shir 1s began at ROF Leeds with the first deliveries scheduled in 1980. However, following the fall of the Shah of Iran, the complete order was cancelled in February 1979.

procured a similar number of American tanks including 300 M47M, 150 M48A5 and 460 M60/M60A1 tanks for use by the tank battalions assigned to infantry and mechanized divisions. Conversely, the Iraqis were equipped almost exclusively with Soviet armour. Following the fourfold increase in the price of oil after the October War of 1973, both Iran and Iraq squandered their vastly increased wealth on foreign weapon systems and waged a war at horrendous human and material cost in a protracted, cruel and grisly conflict of attrition.

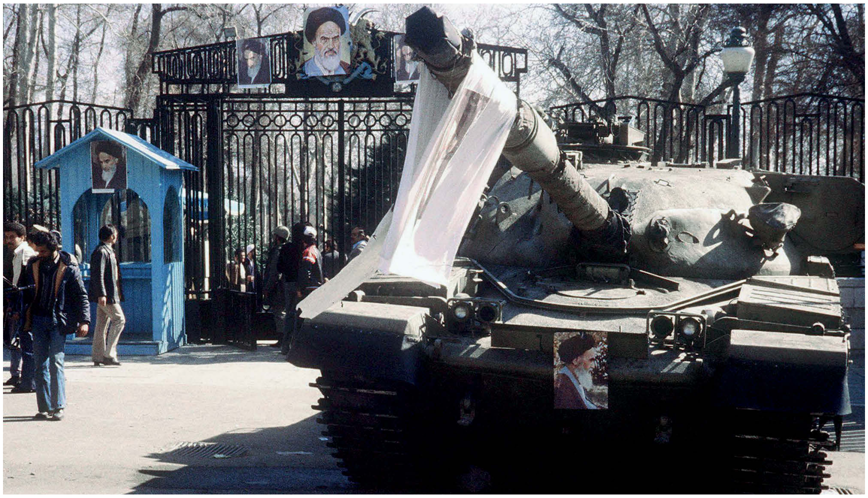


After many years in storage, the remaining fleet of some 300 Chieftains was refurbished and upgraded to become the Mobarez or 'Warrior' in Persian. The rear hull has been extensively modified to accommodate the 850bhp engine of the T-72 and revised fuel tanks. The enhanced suspension provides additional dampening for improved ride characteristics. The fire-control system incorporates a modern laser rangefinder and image-intensification night sights as well as retaining the original white light/infrared projector on the turret side. The Mobarez is fabricated at the Shahid Kolahduz Industrial Complex where T-72 MBTs are also maintained. (Wikimedia Commons)

Even so, Saddam Hussein was greedy for yet more oil and restated Iraq's long-term claim to the Shatt-al-Arab, Khuzestan and the island of Abadan – the largest oil refinery in the world. With Iran in chaos following the Islamic Revolution, Saddam Hussein decided on war in the expectation that the theocratic state would quickly collapse. It was fought in a similar context to that envisaged between the Warsaw Pact and NATO in North-West Europe, with the Iraqis launching repeated assaults with their Soviet armour against the Iranians, who were predominately on the defensive in the early years: a role to which Chieftain was well suited. In the southern desert areas of Iran such as the province of Khuzestan, the Chieftain did not fare so well due to overheating, but against Iraqi T-55 and T-62s the L11 120mm gun proved its superiority with a well-trained crew. As a case in point, the battle of Khorramshahr between 22 September and 24 October 1980 demonstrated the effectiveness of Chieftain in defensive operations.

Long claimed by the Iraqis for its oil riches, the province of Khuzestan suffered massive damage during the war with Khorramshahr virtually destroyed; to both sides it became known as Khuninshahr, meaning City of Blood. On the afternoon of 22 September elements of the Iraqi 3rd Armoured Division and 5th Mechanized Division with some 600 tanks supported by 150 batteries of artillery attacked across the border, employing classic Soviet doctrine. Despite being just 10km from the border, the Iraqi advance on Khorramshahr was painfully slow, allowing the Iranians to evacuate most of the civilian populace as well as constructing several lines of field fortifications with sand berms facing the western approaches. There were no more than 3,000 defenders inside the city including Pasdaran paramilitaries and Basij militia, while some 7,000 troops of the Islamic Republic of Iran Army (IRIA) manned the external defences. Armour support comprised little more than a company of Chieftains of the 232nd Tank Battalion from the 92nd Armoured Division, tasked with the defence of Khuzestan, but woefully understrength. Under command of the division was the 151st Fortress Battalion that manned static antiquated Shermans and Chaffees along the border and in defensive positions in towns and cities. These rarely had supporting infantry so were easy prey for Iraqi T-55s and T-62s.

Most of the Chieftains were deployed along the second berm, leavened by fanatical Pasdaran and Basij fighters with orders to fire on any unauthorized withdrawal from the first line of defences. Battle was joined on 26 September with a two-day bombardment of the sand berms and the city itself. The outer ring soon fell and the Iraqis invested Khorramshahr by 30 September. The Iraqi forces enjoyed a numerical advantage of 4 to 1 in troops and 2.5 to 1 in tanks. While sufficient for normal offensive operations, the ratio was marginal in urban warfare. The initial Iraqi attacks for key areas within the city met with some success but stalled once Iranian Chieftains were encountered. These were dug in at important points with commanding fields of fire down the main avenues and



A Chieftain Mark 5P lies abandoned outside the Shah of Iran's Niavaran Palace in northern Tehran on 12 February 1979 following the Islamic Revolution of Grand Ayatollah Ruhollah Khomeini. The Iranians lost a large number of Chieftains during the Iran-Iraq War of 1980–88. Many were captured, mostly intact, by the Iraqis and approximately 90 were given to Jordan as they could not be incorporated into the Iraqi Army. Others were provided to anti-Iranian dissident groups such as the Iranian National Liberation Army and the People's Mujahedeen Khalq Organization. There is no information as to their use in combat against the Iranians. (Getty Images)

roadways in the suburbs. Iraqi coordination of these early assaults was mediocre and led to heavy losses while Iranian tank/infantry counterattacks at the local level proved highly effective. The Iraqis were obliged to commit yet more reinforcements as their casualties mounted. Eventually superior force prevailed and the Iraqi forces penetrated the old city with its maze of streets and alleyways. In such close confines, the Iranians were able to exact a fearful toll on the attackers. The combination of the Iranian Basij militia and Chieftain tanks working in close cooperation where the Chieftain's limited mobility was not an impediment prolonged the battle for the city for seven weeks. Nevertheless, Iraqi firepower eventually won the battle, and when it was over few buildings remained intact in the city. It was a tactical victory for the Iraqis with approximately 10,000 casualties on each side. But like Stalingrad in the Soviet Union, Khorramshar acquired mythical status in Iran.

Thereafter, stalemate ensued as the fighting became static over the winter. Having failed to capture the oil-rich Abadan region, Saddam called a halt to offensive operations on 7 December 1980. Both sides reflected on the conduct of the war so far. Military operations had been severely compromised by interference and micro-management from on high; be it Saddam Hussein or Ayatollah Khomeini and his mullahs. Furthermore, the dichotomy between the regular troops of the IRIA and the Pasadaran or Revolutionary Guards favoured by the mullahs grew as the war continued, until the Iranian Revolutionary Guard Corps (IRGC) became the predominant organization within the Iranian armed forces. As the Western weapon systems procured by the Shah of Iran diminished and deteriorated through attrition and dearth of spares, so the IRGC was given preference for new weapons procured from abroad; mainly the Eastern Bloc and China. Concurrently, the Basij e-Mustazafin (Mobilization of the Deprived) or youth movement of the IRGC grew in influence and prominence. These boy soldiers of the Basij were to die in their tens of thousands in human wave attacks while declaiming their devotion to Allah and Khomeini. The Iranian army was a shadow of its former self since its officer corps had been comprehensively purged in the early days of the theocratic regime, particularly in the armoured corps. Nevertheless, the latter was still a force to be reckoned with in the early days of the Iran-Iraq War.

On 5 January 1981, the Iranians mounted a major offensive in the Susangerd and Ahvaz region with separate attacks by the IRIA 16th and 92nd Armoured Divisions in Operations Howeizeh and Nassr respectively. Once the two units met on the battlefield, they would then launch a combined assault, codenamed Operation Tavakkol or Trust in God, to facilitate the relief of the vital Abadan area. Unfortunately, much of the battle area was over marshy ground that restricted the movement of the Chieftain tanks to the roads, and whenever they deployed off them, many were lost to bogging in the mud; conditions in which the Iraqi T-62s could still manoeuvre to a degree. There followed the largest tank battle of the war with some 450 tanks in action. The combination of Chieftains and AH-1J Cobra gunships armed with BGM-71 TOW ATGMs proved decisive at the outset, but many Chieftains were abandoned in the mud, some with their engines still running. Although the L11 120mm gun of Chieftain and its fire-control system proved superior to the T-62, particularly during long-range engagements, this was the first battle in which the Iraqis deployed the T-72 tanks of 10th Armoured Brigade. The 125mm APFSDS round proved capable of defeating Chieftain's armour at all combat ranges. Over a matter of days, the Iranians lost some 100 M47M, M60 and Chieftain tanks knocked out and a further 150 captured, many of them intact. Iraqi losses were some 70 T-62 tanks as well as three T-72s destroyed by Cobra gunships. The offensive floundered in the mud and marshes of the Karkheh River with Saddam claiming an overwhelming victory.

Thereafter IRIA armoured divisions withered on the vine as the Pasadaran and Basij became preeminent. Most Chieftains were subsequently withdrawn to strategic reserve as the T-54 series became the predominant MBT. Many of the captured Chieftains were recovered and refurbished by the Iraqis but were not taken into service. Estimates vary between 200 and 300 Chieftains fell into Iraqi hands during the war. In 1988, 90 were given to Jordan and many of the remainder were provided to the Kurdish separatist group in their longstanding campaign against the Iranian authorities. The performance of Chieftain during the Iran-Iraq War was marginal due to a variety of factors, not least of which were the inadequacies of the L60 engine particularly in the hot desert conditions. The problems were compounded by the purge of the armed forces after the Islamic revolution that radically reduced both military and technical skills within the IRIA; the lack of training of replacement crews; the lack of spares due to foreign arms embargos; and the constant interference in military operations by the mullahs.

For the Iranians, one of the fundamental lessons of the Iran-Iraq War was the necessity to become as self-sufficient as possible in weapons production, including tanks. Every type of tank within the Iranian inventory was upgraded, be they American, British or Russian. Each remains in service to this day with the M60 becoming the Samsam; the Chieftain becoming the Mobarez; the T-54/55 series becoming the Safir; while a combination of the M60 and the T-72 became the first indigenously produced MBT named the Zulfiqar (or Zolfiqar) – the legendary sword of Ali the fourth Caliph. Production of the Zulfiqar series began in 1997 at the Shahid Kolah Dooz Industrial Complex. Latterly, the Iranians have produced the Karrar or 'Striker' MBT, which is a synthesis of all the tanks that have served in the IRIA and IRGC since 1979. The design incorporates all the latest characteristics including composite and reactive armour; Active Protection System; an auto-loading 125mm main armament capable of firing laser-guided anti-tank missiles; and a Remote Weapon System mounting a .50-cal machine gun with a distinct resemblance to the Russian T-90MS. As the Russian major general Vladimir Bogatyrev observed: 'It is based on the T-72 platform, but it also has something from the American Abrams and M60 tanks. Some elements are borrowed from the M48 and the British

Chieftain tank. They took all these factors and tried to design their own tank'. But now Iran is the only Middle East country that is capable of designing, developing and manufacturing a main battle tank even if much of the technology is thanks to reverse engineering.

KUWAIT: THE BATTLE OF THE BRIDGES

The cost to both countries of the Iran-Iraq War was enormous in blood and treasure. For much of the war, the regime of Saddam Hussein was subsidised by other Sunni nations such as Kuwait and Saudi Arabia. Even so, Iraq was impoverished by the war and deeply indebted from years of huge arms purchases. Saddam turned his baleful eyes southwards and reiterated the longstanding Iraqi claim that Kuwait was Iraq's nineteenth province. On 2 August 1990, Iraqi forces invaded Kuwait spearheaded by the experienced 1st Republican Guard Corps with the Hammurabi Mechanized and Medina Armoured Divisions. The latter comprised two armoured brigades and a mechanized brigade equipped with T-72 tanks and BMP IFVs respectively. Each division was supported by three battalions of 2S1 and 2S3 self-propelled artillery together with reconnaissance, engineer and air defence units. This formidable force was well equipped and manned by battle-hardened troops.

The Kuwaitis were taken completely by surprise even though the Iraqi army had been massing on the border since 19 July. The Kuwait Land Forces consisted of four brigades, plus the Emiri Guard and the 25th Commando Battalion. The 6th Mechanized Brigade was in the north, with Vickers Mark 1 MBTs and M113s and BMP-2s. The 15th Mechanized Brigade was south of Kuwait City, with two battalions of Chieftain tanks and M113s. The 80th Infantry Brigade was in Jahra, with light infantry supported by some Saladin armoured cars. Finally, the 35th Armoured Brigade was west of Jahra on the Salmi road. The latter was commanded by Colonel Salem Masoud Al Sorour, and incorporated the 7th and 8th Tank Battalions with 36 Chieftains, the 57th Mechanized Infantry Battalion, an anti-tank company, and the 51st Artillery Battalion. Both tank battalions were equipped with Chieftain Mark 5/2K tanks. The 57th Infantry Battalion was equipped with both M113 APCs and BMP IFVs. The brigade antitank company employed M901 Improved TOW Vehicles and the 51st Artillery Battalion M109A2 155mm self-propelled howitzers.

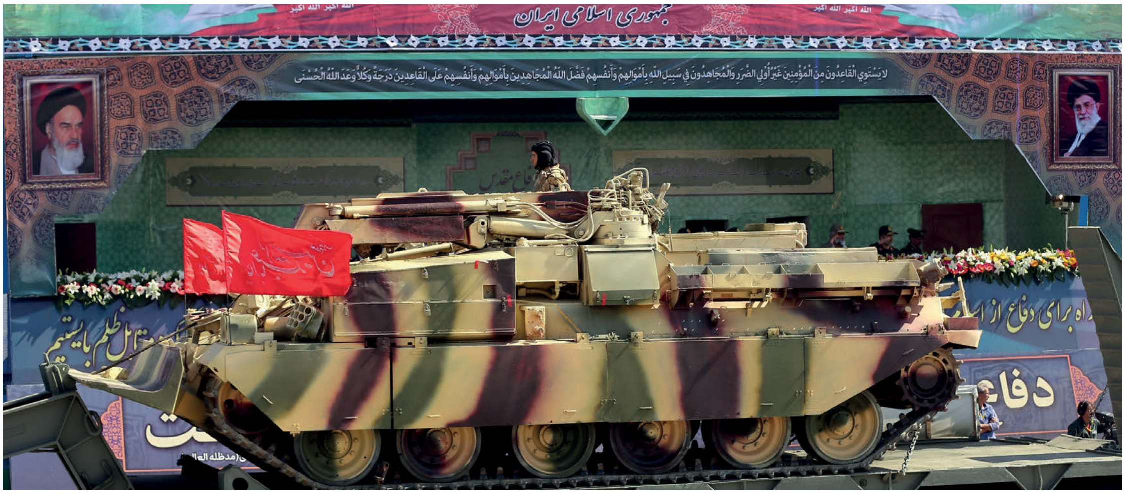
The Chieftain was first procured by Kuwait in October 1976 with a total of 165 delivered by March 1980. The high temperatures of the country tested the L60 engine to the full despite the assiduous efforts of British technicians. Within the Kuwaiti army, the Chieftain was appreciated for its firepower but its automotive performance was inadequate both in horsepower and reliability. To address the latter, the Kuwaitis initiated an upgrade programme by installing an MTU 1,000bhp engine and Renk transmission. The Kuwaitis also procured the M84AB MBT: an upgraded version of the T-72M1 manufactured in Yugoslavia. Out of an order of 200 tanks, at the outbreak of war just six had been delivered to the Emiri Guard. This was separate from the Kuwait Land Forces and tasked with the protection of the Emir of Kuwait and his family.

The 35th Brigade got its first inkling of the impending invasion at 2200hrs on 1 August. Over the next eight hours frantic efforts were made to fuel and bomb up their AFVs but by morning only 36 Chieftains, seven M109A2 SPGs and a number of APCs were ready for action. There was not enough time to boresight the tank weapons and several vehicles had insufficient water for their crews; a grave oversight in the scorching heat of August. The 7th Battalion went into battle some 50 per cent understrength with 26 Chieftains while the 8th Battalion had just ten. The Chieftains of 7th Battalion were dispersed among three companies with nine, ten and seven respectively. The 8th Battalion grouped its ten Chieftains into its 3rd Company. The 57th Battalion provided a single infantry company with five BMP-2s and a handful of M113 APCs while the 51st Artillery Battalion formed a composite firing battery of seven guns out of 18 on strength. Meanwhile two sections of M113 ITVs of the anti-tank company under the command of Colonel Salam had deployed with one to provide security at the Al Salem airbase and the other to the intersection of the Salmi Road and the Sixth Ring Road.

These elements of 35th Brigade moved out eastwards at 0600hrs along the Salmi Road (Highway 70) to the vicinity of the Al Ghanim Oasis with the 7th Tank Battalion leading. Reconnaissance troops soon identified tanks from 17th Brigade of the Hammurabi Division moving westwards along the six-lane Sixth Ring Road in column order without flanking or scouting units. Soon after 0645hrs, the Chieftains of 7th Battalion engaged the Iraqi tank columns at ranges between 1,000 and 1,500m. Firing from the north of Highway 70 in such a target-rich environment, the Chieftains exacted significant casualties, bringing the Iraqi columns to a halt. The 8th Tank Battalion soon arrived on the south of the road and joined the fray. The 3rd Company commander, Captain Ali Abdulkareem, positioned his Chieftains covering two bridges over the Sixth Ring Road. An Iraqi command vehicle was identified under a bridge and Captain Ali ordered his gunner to engage. He destroyed it with his first round and there are burn marks under the bridge to this day. Seemingly unaware of the unfolding drama, Iraqi tanks and trucks continued to advance but by now the Chieftains were low on ammunition. Vehicles were despatched back to camp for more supplies but too late.

At 1100hrs, a column of tanks was observed moving up from the south towards the Kuwaiti forces, passing through the artillery position and between the 7th and 8th Battalions. Confusion reigned until it was realized that they were the advance guard of the Medina Division. Effective fire was opened at close range with Iraqi troops and vehicles falling victim to both Chieftains and artillery as well as an airstrike by an A-4 Skyhawk with five Mark 82 500lb bombs. Undaunted, the Iraqis regrouped and attacked in overwhelming force with two brigades of the Medina Division deployed. Colonel Salem requested reinforcements and supplies from headquarters

A Chieftain Mark 7 ARRV is driven past Iranian military commanders during the annual parade marking the anniversary of the start of Iran-Iraq War of 1980-1988 on 22 September 2015, in the capital, Tehran. (Getty Images)



but nothing was forthcoming. Now caught between the Medina and Hummurabi Divisions, 35th Brigade was in a precarious situation with most tanks down to two or three rounds of main armament ammunition. Contact was broken and the Chieftains moved southwards and arrived at the Saudi Arabian border at 1630hrs. After contacting the relevant Saudi authorities, the brigade with 26 remaining Chieftains crossed over the next morning. Eighteen of these Chieftains took part in the liberation of Kuwait as part of 35th Shaheed (Martyr) Brigade bolstered by newly acquired M84AB MBTs. Most of the Chieftains captured by Iraq were eventually returned to Kuwait. All the Chieftains were soon replaced by the Abrams M1A2 MBT.

CHIEFTAIN SPECIAL-PURPOSE VARIANTS

FV4204 CHIEFTAIN ARMOURED RECOVERY VEHICLE

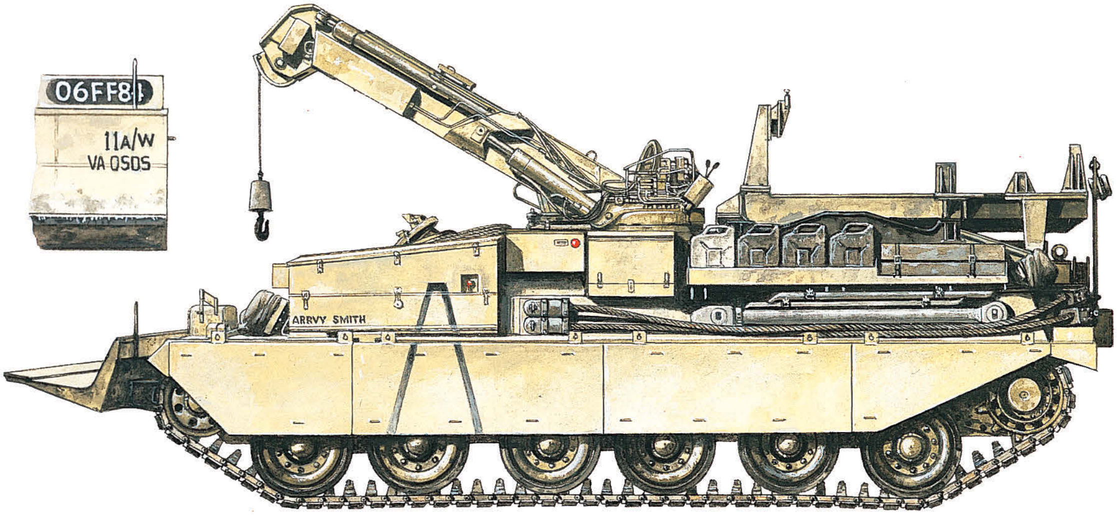
The introduction into service of a new MBT invariably heralds the development of a number of special-purpose variants based on the hull of the tank to allow comparable performance on the battlefield and to achieve commonality of fuel and spares support. When the Chieftain MBT entered service from 1967 onwards, a family of special-purpose variants based on the Centurion initially supported it. Although they proved adequate for the task, the Centurion was powered by petrol and did not have the road speed of Chieftain, which used diesel.

Of all the special-purpose variants of a tank, the Armoured Recovery Vehicle or ARV is the most important. Its principal task is to recover bogged or damaged MBTs on the battlefield and provide front-line servicing and repairs to broken-down tanks. The Centurion ARV had been in service with the REME since 1955 and, although rugged and reliable, had several limitations, not least of which was its inability to recover a tank from the front with the crew protected under armour. This deficiency was overcome in the design of the Chieftain ARV that was endorsed by the General Staff in November 1964. The requirement also stated that the ARV should act as a 'pathfinder' vehicle during water crossing operations so it was to have a deep wading capability. Project studies were initiated and full development followed within REME and at ROF Leeds.

OPPOSITE With its Atlas crane deployed to the front, a Chieftain Mark 7 ARRV of the 2nd Royal Tank Regiment Battlegroup tows a disabled Chieftain CHAVRE during Exercise Uhlan Eagle '96 in Poland. Because of their front-mounted dozer blades or mineploughs, CHAVREs and CHAVLBs have to be towed backwards during recovery operations. The REME crew have erected a tarpaulin over the engine decks to make a comfortable sleeping quarter at night with the benefit of residual engine heat to keep them warm, a common ploy during field exercises.

Automotively, the ARV was identical to the Chieftain Mark 5 MBT. Similar in configuration to the Conqueror ARV, it featured an armoured hull and superstructure housing the crew, and a 30-ton main capstan winch and a 3-ton auxiliary winch, both of which were located in the front right-hand side of the vehicle. The main winch was mechanically driven, via a power take-off and propeller shaft, by the main engine. By means of block and tackle, the ARV was capable of exerting a 90-ton pull with the front dozer blade acting as an earth anchor; this was sufficient to recover any AFV in service. Such an arrangement allowed the crew and the winch, and therefore any recovery operation, to be carried out from under armour protection once the main cable had been attached to the casualty.

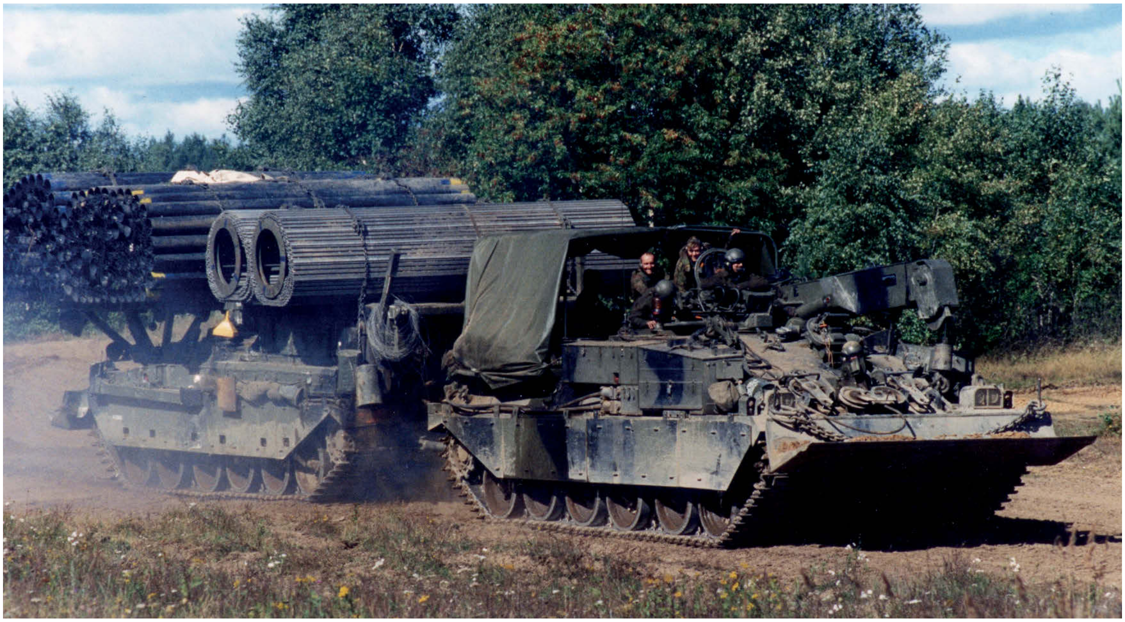
Four special-purpose prototypes were built by ROF Leeds including two ARVs (R1 and R2) and two AVREs (E1 and E2), which were completed in early 1971. However, many serious problems were discovered during the initial manufacturer's trials leading to a complete redesign of the hydraulic controls system by Lockheed Precision Products. User trials of R1 were undertaken at SEME Bordon between September and December 1971. These revealed a fundamental weakness in the dozer blade/earth anchor, and a major failure of the main winch curtailed the trials prematurely. Meanwhile, Prototype R2 had been modified with the new hydraulic



CHIEFTAIN MARK 7 ARRV, FORWARD REPAIR GROUP, 4TH ARMOURED BRIGADE, OPERATION GRANBY, FEBRUARY 1991

The deployment of hundreds of AFVs into the Saudi Arabian desert demanded massive REME support to maintain and modify them for the coming offensive. With no base workshops, almost all work had to be undertaken in the open under the most difficult conditions. Besides the dedicated Chieftain ARRVs in each armoured squadron, further ARRVs, including the first production models of the Challenger ARRV, were deployed in support of the armoured regiments in Forward Repair Groups or FRGs. This Chieftain Mark 7 ARRV is named ARRVY SMITH after the famous show jumper Harvey Smith and the name is carried on both sides of the vehicle forward of the black chevron mutual recognition device. On the other side of the vehicle above and behind the name ARRVY SMITH is the unit zap code 1/6/FRG denoting this vehicle was deployed in support of 4th Armoured Brigade.

The vehicle registration number 06FF84 is carried on the front right and right rear trackguards as viewed and below the front one is an inscription on the dozer blade as shown in the scrap view. This ARRV carries a cradle for a spare powerpack for a Challenger MBT over its engine decks for replacement in the field by means of the hydraulic crane.



01F049

control system and it underwent trials at SEME during 1972. These comprised intensive testing of the vehicle with two shifts of REME craftsmen operating the ARV for seven days a week with night exercises and two 24-hour 'closed down' operations. During these trials, the cumulative winch usage achieved was more than twice that estimated as the maximum before base overhaul was necessary.

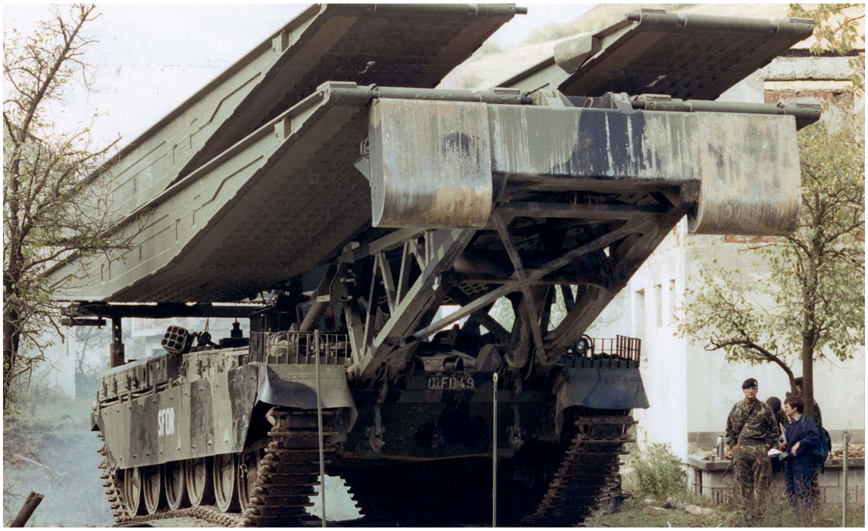
After various modifications and improvements, production was undertaken by Vickers at Elswick. In total, 257 ARVs were built at Newcastle-upon-Tyne, with the first deliveries to the British Army in 1974. Foreign users included Iran, which received 41 out of an order for 73, while Jordan procured further vehicles. This version featured an Atlas AK 6000M hydraulic crane with a maximum lift of 6.5 tonnes that allowed the ARV to replace major assemblies such as a powerpack in the field.

Initially, the British Army employed the FV434 Fitters Vehicle for this purpose but the advantages of having an integral crane on the Chieftain ARV soon became apparent. It became vital when the Challenger 1 MBT entered service, as the FV434 Fitters Vehicle was incapable of lifting the Challenger powerpack. Accordingly, British Chieftain ARVs were reworked to carry the same Atlas hydraulic crane. This model was designated the Chieftain Mark 7 Armoured Repair and Recovery Vehicle (ARRV) and later CHARRV to differentiate it from the Challenger ARRV or CRARRV. At one stage it was planned that the ARRV would carry a spare powerpack on a cradle above the engine deck but this made the vehicle conspicuous when operating tactically in the field. Furthermore, it was incapable of passing under many road bridges. Instead, special trailers were built to carry the powerpacks, although the cradles were fitted to several ARRVs during the Gulf War of 1991 in the wide open stretches of the desert, where bridges did not pose a problem. The Chieftain ARRV remained in service with the British Army well into the late 1990s when the Challenger ARRV superseded it.

OPPOSITE A Chieftain Mark 5 AVLB of the Implementation Force or IFOR demonstrates the versatility of combination bridging near Sanski Most on 16 July 1996. Having laid a No.9 Tank Bridge with end trestle, the AVLB is laying a No.10 Bridge to span the river. By these means, gaps up to a nominal 60m span can be bridged at Military Load Classification of 70 tonnes (MLC70).

FV4205 CHIEFTAIN ARMOURED VEHICLE LAUNCHED BRIDGE (AVLB)

As a replacement for the Centurion Mark 5 Bridgelayer, a vehicle designated Chieftain Mark 5 AVLB (Armoured Vehicle Launched Bridge) was developed by MVEE (Military Vehicles and Engineering Establishment – the former FVRDE) and Lockheed Precision Products of Birmingham for the hydraulic lifting mechanism.



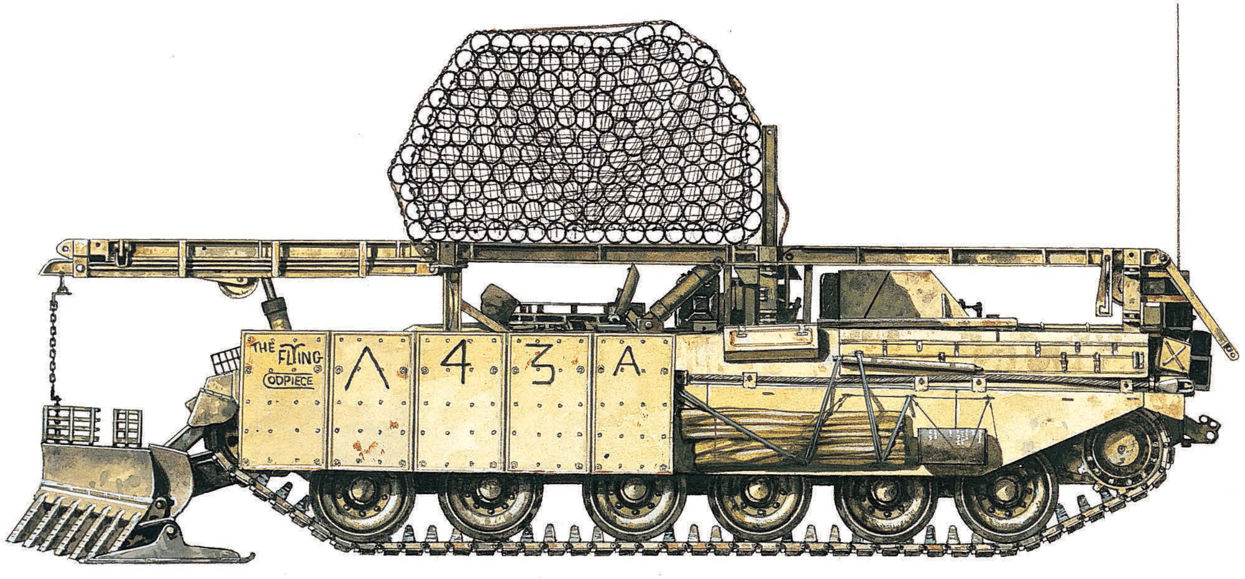
The BR90 Close Support Bridging System comprises three different types of tank-launched bridges capable of spanning gaps from 12m to 24.5m or more by combination bridging. This Stabilization Force (SFOR) Chieftain Mark 5 AVLB in Bosnia is carrying two No. 12 Tank Bridges, which can be launched independently. Other bridges are carried by the Tank Bridge Transporter based on the Alvis Unipower 8 x 8 chassis.

Four prototypes were built at ROF Leeds with the first model being delivered in September 1967 for troop trials with the Royal Engineers. The launching mechanism was hydraulically operated and derived its power from a pump driven by the main engine. Three sets of rams launched the bridge vertically over the chassis with the launch sequence taking under three minutes with little or no bank preparation. The AVLB carried either of two bridges – a scissors-type No.8 Tank Bridge and a rigid No.9 Tank Bridge. The No.8 Tank Bridge had an overall length of 80ft capable of bridging a gap of 75ft – a far greater capability than any contemporary foreign bridgelayer. The No.9 Tank Bridge was carried horizontally on the vehicle and swung vertically through 180 degrees to span a gap up to 40ft. Both bridges were made of a zinc/aluminium/magnesium (ZAM) alloy and maraging steel for maximum strength and minimum weight. Each was capable of carrying AFVs weighing up to 80 tons.

ROF Leeds undertook series production of 37 Chieftain Mark 5 AVLBs from 1972, with the first deliveries to the British Army in 1974. Three Sappers from the Armoured Engineer Regiments of the Royal Engineers manned each AVLB. The AVLB's role was to provide armoured engineering support by bridging waterways and anti-tank obstacles to maintain the advance of an armoured formation on the battlefield. It was normally deployed as part of a 'bridging train' with each AVLB having support vehicles carrying supplementary bridges, either No.8 or 9, for maximum flexibility. All bridges were capable of being recovered from either end in less than ten minutes (in ideal conditions).

In March 1984 Vickers Defence Systems was awarded a contract to convert 11 Chieftain Mark 1/4 MBTs into the Chieftain Mark 6 AVLB. Employing the same launching system as the earlier AVLB, user trials were completed by November 1985 and the vehicles were delivered to the British Army between June and September 1986. These vehicles, as well as the earlier AVLB models, were equipped with fitments to mount a range of mineploughs and dozer blades to extend their flexibility in the armoured engineering role on the battlefield. During the Gulf War of 1991, equipment of this type was fitted to most of the Chieftain AVLBs, now designated CHAVLB, for use in the mine-clearing role as well as for bridging. Besides the Pearson Engineering mineplough system mounted at the front of the hull, they also carried a device known as MIMIC to detect and activate mines with magnetic fuses. All the CHAVLBs deployed for Operation Desert Sabre were fitted with Chobham armour panels along the sides of the crew compartment to increase survivability.

Following the Gulf War, the original No.8 or No.9 Tank Bridges carried by CHAVLB were replaced by the new Close Support Bridging (CSB) system – part of the overall BR90 (Bridging for the Nineties) series developed for the British Army. The Close Support Bridge system consists of a set of three tank-launched bridges, a modification kit for the CHAVLB and a Tank Bridge Transporter truck based on the high-mobility Alvis Unipower 8x8 vehicle. All of these bridges take a maximum of three minutes to lay and five minutes to recover under ideal conditions, and comprise: the 26m-long (85ft) scissors-type No.10 Tank Bridge that can span a gap of 24.5m (80ft); the 16m-long (52.5ft) No.11 Tank Bridge of the up-and-over type, that can span a gap of 14.5m (47.5ft); and the 13.5m-long (44ft) No.12 Tank Bridge, also of the up-and-over type, that can span a gap of 12m (39ft). The launching system allows two No.12 Bridges to be carried at the same time. To increase flexibility, combination bridging is possible using two or three bridges with the far end supported on the bottom of the gap or on a trestle to allow obstacles of up to 5m (16ft) deep and 60m (196ft) wide to be spanned for vehicles weighing up to 70 tons.

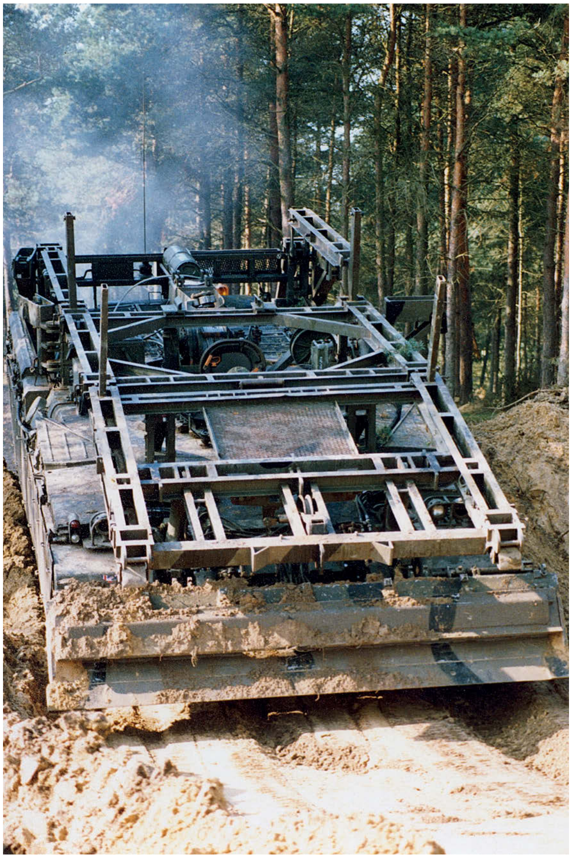


CHIEFTAIN AVRE, 23 ENGINEER REGIMENT, OPERATION GRANBY, FEBRUARY 1991

The Chieftain AVREs deployed on Operation Granby were of the Willich type. The extensive fortified lines created by the Iraqis along the Kuwaiti border with Saudi Arabia were initially believed to be a formidable obstacle requiring considerable engineer assets to breach them. Each of the battlegroups within the 1st (UK) Armoured Division was given its own integral Royal Engineer close support troop. This commonly comprised two AVREs, two AVLBs, two Combat Engineer Tractors, two field sections in FV432s and up to three CVR(T) Spartans for command and reconnaissance roles. This AVRE is being prepared for combat prior to the land offensive. Beside the Maxi-Pipe fascine, it has been fitted with a full-width mineplough and chain armour at the front to detonate RPGs fired at the drivers compartment. Further protection to the crew compartment has been provided along the sides in the form of Warrior Chobham armour panels and these bear the vehicle callsign of Four Three Alpha and the vehicle nickname of THE FLYING CODPIECE. The vehicle registration number 05EB44 is carried on the rear right trackguard as viewed. This vehicle is yet to be fitted with MIMIC (Magnetic Influence Mine Induction Coil) above the mineplough and the Giant Viper trailer. A typical AVRE load during Operation Desert Sabre was two Maxi-Pipe fascines and one roll of Class-60 Trackway. Fifteen out of the fleet of 18 CHAVREs were deployed on Operation Granby with six each in 21 and 23 Engineer Regiments and three in War Maintenance Reserve.

CHIEFTAIN ARMOURED VEHICLE ROYAL ENGINEERS (CHAVRE)

Two versions of a Chieftain AVRE, designated Armoured Engineer Vehicle Gun and Armoured Engineer Vehicle Winch were originally developed to replace the venerable Centurion AVRE, but the project was cancelled in 1971 in favour of the Combat Engineer Tractor. With the advent of Challenger 1 as the frontline MBT in BAOR, the Centurion AVRE was hard pushed to keep up with the other AFVs within the battlegroup. As more armoured regiments were equipped with Challenger 1, the redundant Chieftain MBTs became available for other purposes. The Royal Engineers Wing at Bovington addressed the problem and suggested that a Chieftain stripped of its 12-ton gun turret would have greater battlefield mobility and speed than the Centurion AVRE, even when fitted with a range of engineer stores. The primary roles of the new AVRE were mine clearance, with a combination of mineplough and Giant Viper, and the carriage of Class 60 Trackway or Maxi-Pipe fascines to negotiate various obstacles on the battlefield. The Centurion AVRE was only capable of carrying either a single roll of trackway or one fascine, which was woefully inadequate. A vehicle able to carry either three fascines or six rolls of trackway was required with the ability to deploy them from under armour without exposing the crew to hostile fire.

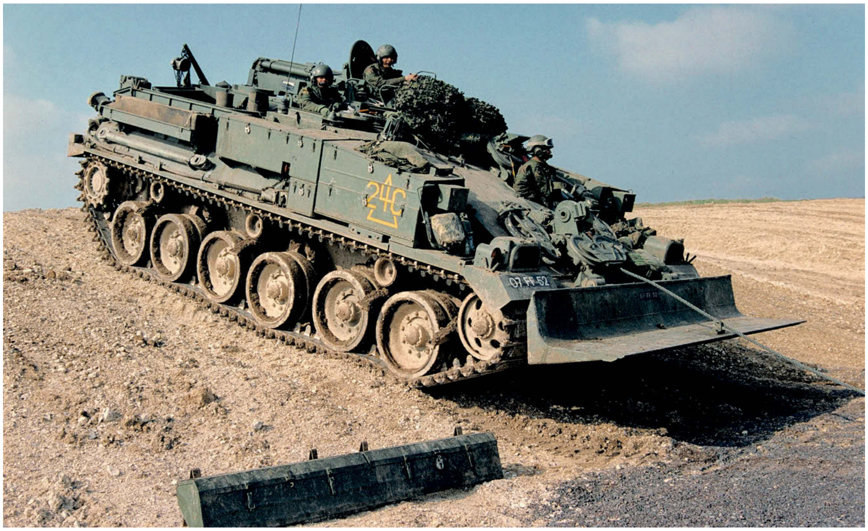


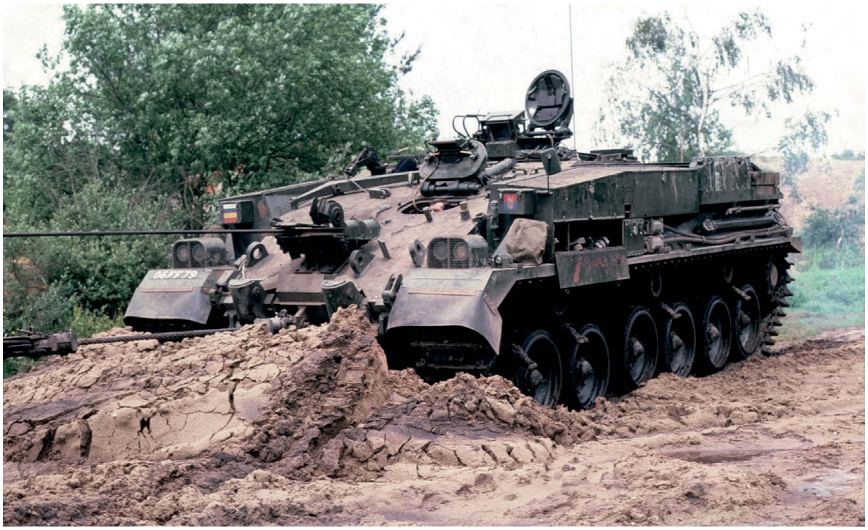
The first Chieftain AVREs were simple conversions of redundant gun tanks undertaken by the 21 Engineer Base Workshop of 40 Army Engineer Support Group at Willich in West Germany. Seventeen of these vehicles were built and they became known as 'Willich AVREs'. This example shows the hull-mounted steel frame in two sections that was originally called the 'roof rack' and subsequently the 'hamper'.

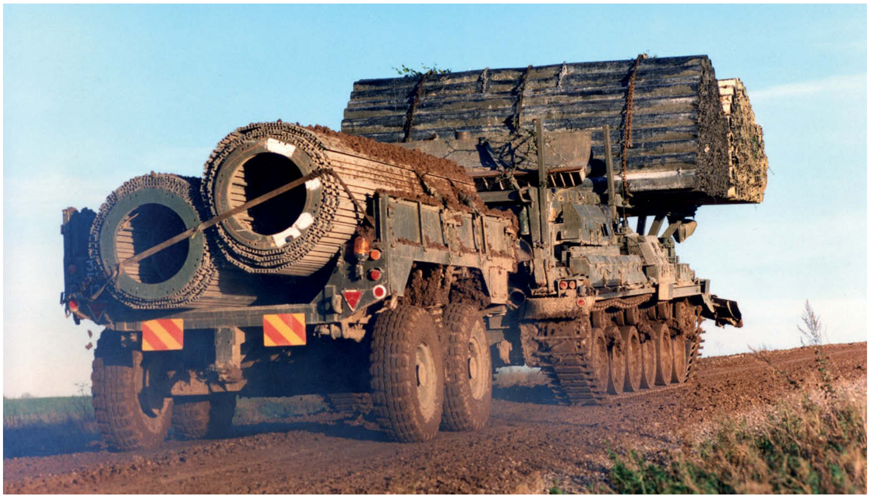
Working in conjunction with 32 Armoured Engineer Regiment, the RE Wing produced a 'concept demonstrator' that showed considerable promise. In early 1986 a requirement for 12, subsequently 17, vehicles was issued, with 12 to be ready for troop trials in BAOR before the autumn manoeuvres of 1987, two for the British Army Training Unit at Suffield (BATUS) in Canada, two for the RE Wing at Bovington, and a base model for Vickers Defence Systems. However, no civilian contractor was willing to meet the strict deadline and there was no spare capacity in REME base workshops to undertake the conversions. The Sappers had to rely on their own resources.

The task was given to 40 Army Engineer Support Group and 21 Engineer Base Workshop at Willich in West Germany. With commendable energy and alacrity, the first Chieftain AVRE was delivered on 9 August for user trials with 32 Armoured Engineer Regiment. These trials suggested a number of modifications, which were incorporated in the next two AVREs during conversion before they were delivered on 9 October. After further user trials and another 40 suggested modifications, the design was sealed and production of the remaining 14 vehicles was undertaken. The first three models were then modified to the production standard so that all 17 were completed on schedule at a unit cost of some £80,000 whereas the initial industry estimate was in the region of £380,000 per vehicle. These vehicles became known as the 'Willich AVREs' and they proved to be highly successful, though service use did indicate some shortcomings. In late 1989 Vickers Defence Systems was awarded a contract for the design, development and conversion of a further 48 Chieftain gun tanks to Chieftain AVRE or CHAVRE. The contract was for two prototype vehicles and 46 production vehicles of enhanced capability in two batches. The first two prototypes were completed in 1991 with production running until 1994. Meanwhile, the Willich AVREs were deployed to the Gulf for Operation Granby and the liberation of Kuwait.

The definitive CHAVRE was designed to maintain the mobility of the battlegroup by breaching minefields and overcoming obstacles such as anti-tank ditches and in creating obstacles to impede the advance of the enemy by acting as a prime mover for minelaying equipments. To this end, a load-carrying platform is fitted over the top of the vehicle chassis. This platform or 'hamper' extends over the full length of the vehicle and is split into two sections, each of which can be operated independently. The hamper can carry up to 14.5 tons of equipment, be it fascines, trackway, bridging or general stores such as mines. Each section of the hamper can be tilted by hydraulic rams using remote control from under armour. This allows the fascines or trackway to be launched to both front and rear with the loads secured by chains that are cut by explosive bolts. The loading and positioning of stores onto the hamper is achieved using the vehicle's integral crane or winch.



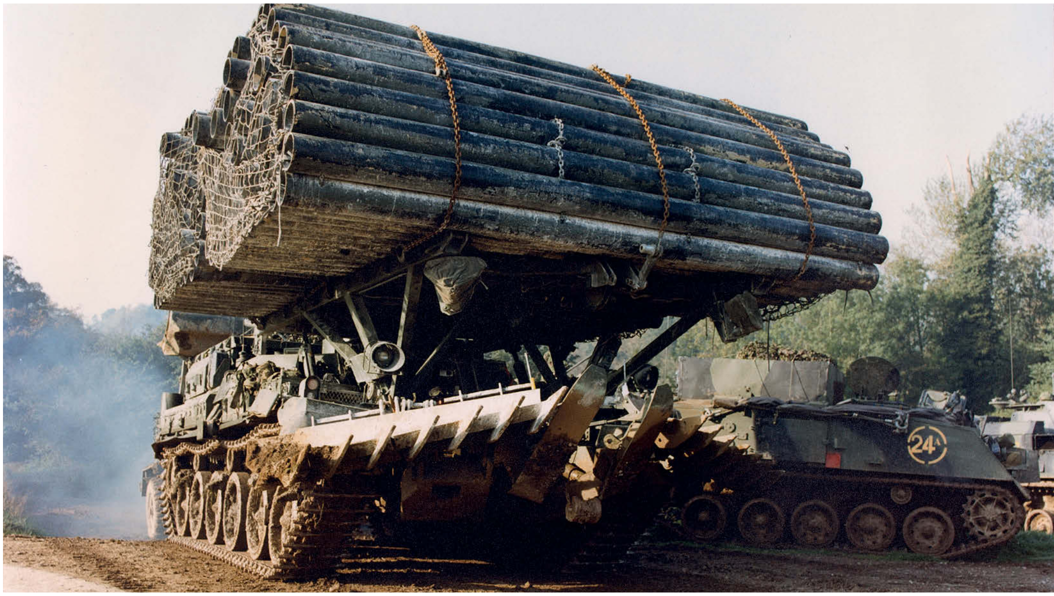




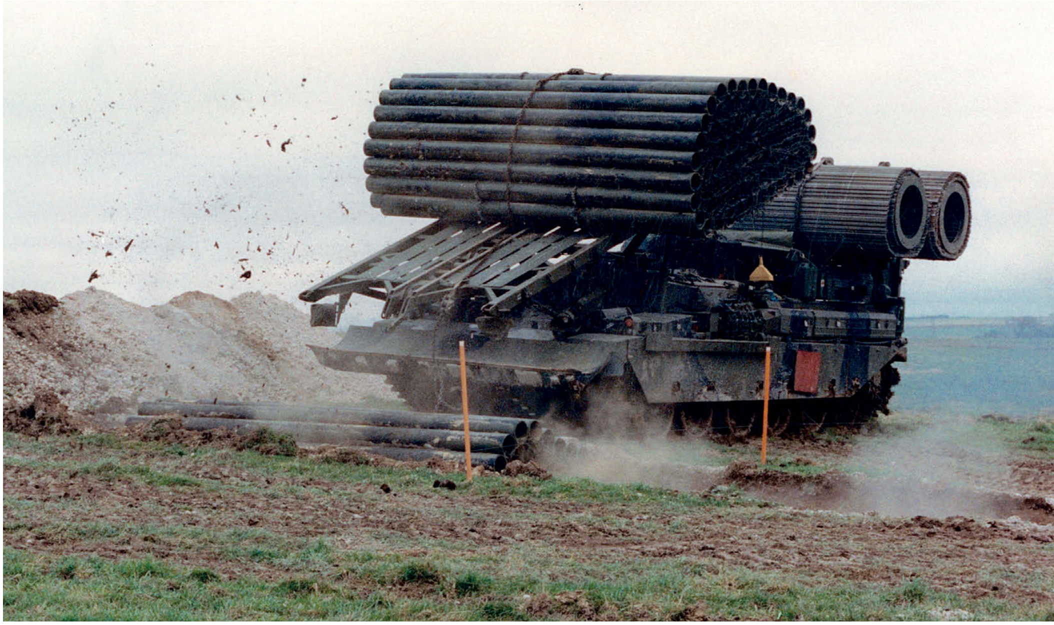
TOP With a crew of four, the Chieftain ARV had a fully loaded weight of 54.7 tonnes (56,000kg) and the armament comprised a cupola-mounted 7.62mm L37A1 machine gun and smoke grenade dischargers. Two Chieftain ARVs manned by REME crews supported each armoured squadron within the Royal Armoured Corps. This example is a later Chieftain Mark 7 ARRV or Armoured Repair and Recovery Vehicle, attached to A Squadron, The Royal Scots Dragoon Guards, during Exercise Phantom Bugle on the Salisbury Plain Training Area in 1995. The ARRV featured an Atlas crane with a lifting capability of 6.5 tonnes at 3.2m radius, so it was able to remove the complete powerpack of Challenger 1, which weighed 5.5 tonnes.

LEFT The Chieftain Armoured Recovery Vehicle Mark 5 was introduced into service with the British Army in 1974 to supersede the venerable Centurion ARV Mark 2. Unlike its predecessor, the Chieftain ARV undertook recovery operations from the front, as here with 3 to 1 tackle producing a maximum 90-ton pull with the front dozer blade acting as an earth anchor.

BOTTOM The 7½-ton AVRE trailer is designed to carry all manner of engineer stores and to be manoeuvrable in all types of terrain. This trailer carries Class 60 Trackway for laying at water crossing points with two Maxi-Pipe fascines on the front hampers, while slung across the rear decks is a dozer blade that is interchangeable with front-mounted mine plough kit.

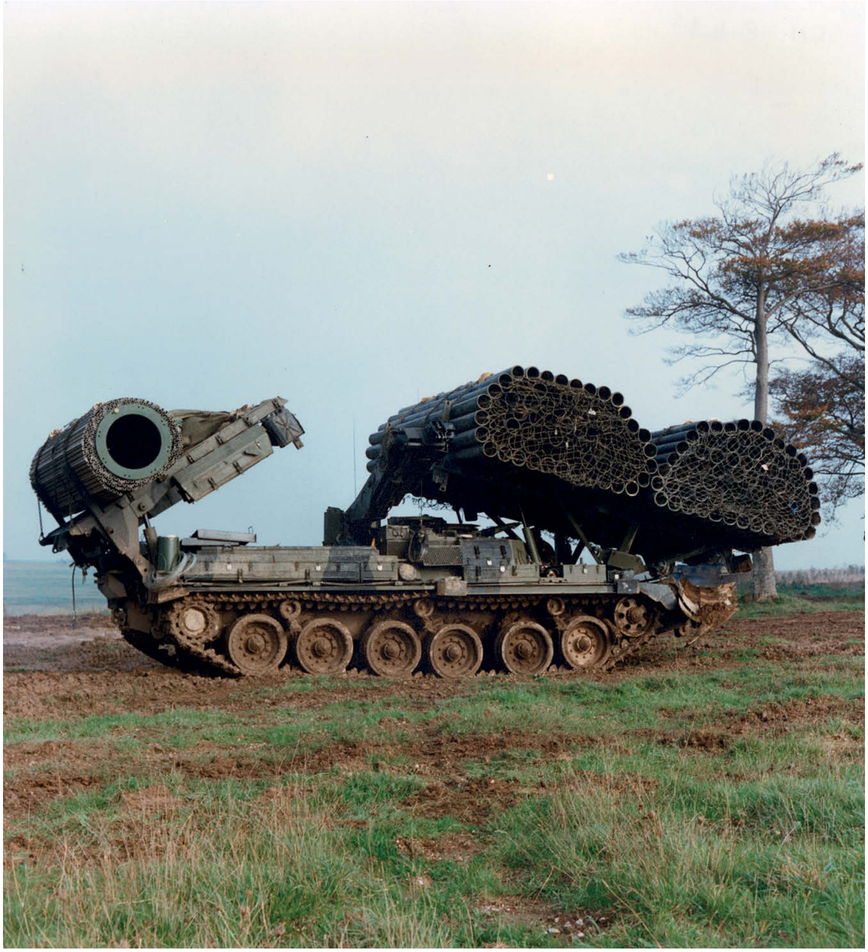


TOP A CHAVRE attached to 2nd Royal Tank Regiment during an exercise on Salisbury Plain Training Area. The driver is positioned centrally, as in the Chieftain MBT, while, just behind him, the commander is visible in the armoured crew compartment. Up to five sappers can be housed under armour with the benefit of collective NBC protection. This vehicle shows the Pearson Engineering full width mineplough to effect and its load of two Maxi-Pipe fascines. These are made up of standard commercial PVC waterpipes. Though many of the individual pipes are crushed or split after vehicle crossings, they are cheap to replace. The ends of the fascines are covered with netting to prevent the pipes becoming clogged with debris when dropped into streams or rivers.



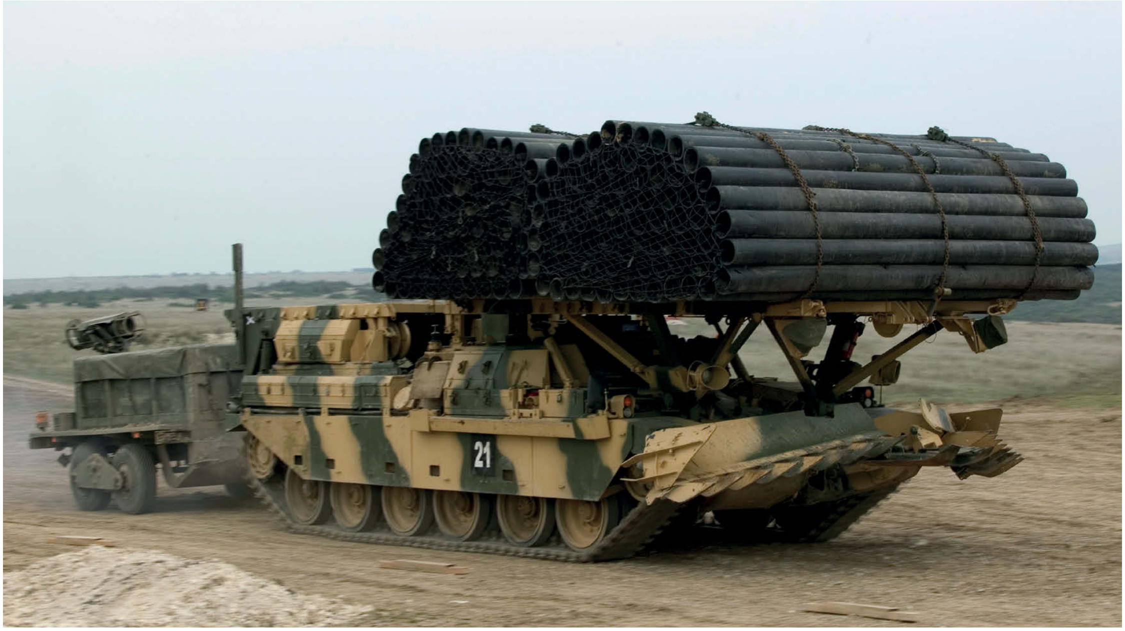
BOTTOM A Maxi-Pipe fascine drops into an anti-tank ditch from the front hamper of a CHAVRE during a training exercise. The fascine is released remotely from under armour by the firing of explosive bolts attached to the securing chains. A normal CHAVRE load is two Maxi-Pipe fascines and two rolls of Class 60 Trackway but any combination can be carried, such as three fascines, or up to nine rolls of trackway. The trackway is used as approach matting to bridging sites or crossing points to prevent large numbers of AFVs from churning up the ground and making it impassable to following vehicles.

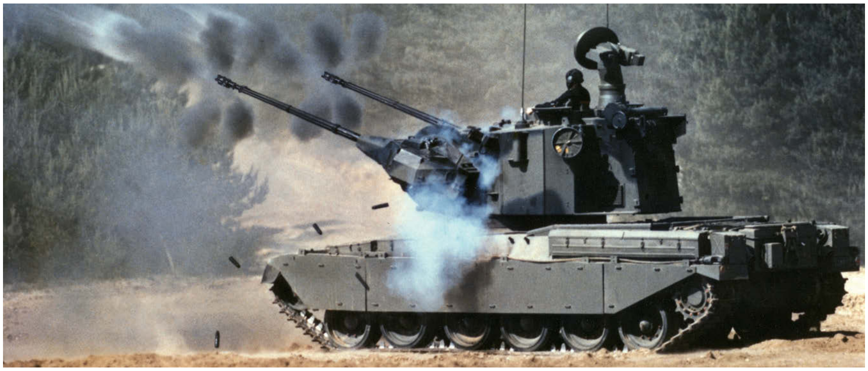
The CHAVRE is fitted with a Ferrari hydraulic crane to lift loads onto and off the hamper. It has a maximum load capacity of 2.9 tonnes with a reach of 5m and can also be used in vehicle maintenance to remove assemblies such as engine decks or gearbox. A Rotzler capstan winch is fitted to the rear of the vehicle to assist in handling stores and recovering fascines that have been launched. The winch has a maximum capacity of 10 tonnes. For mine clearance and earthmoving, the CHAVRE has fittings to accept the Pearson Engineering mineplough or universal dozer blade, each of which can be fitted by the vehicle's own crane. The CHAVRE can also tow two Giant Viper trailers to project explosive lines over minefields and fire them from under armour.



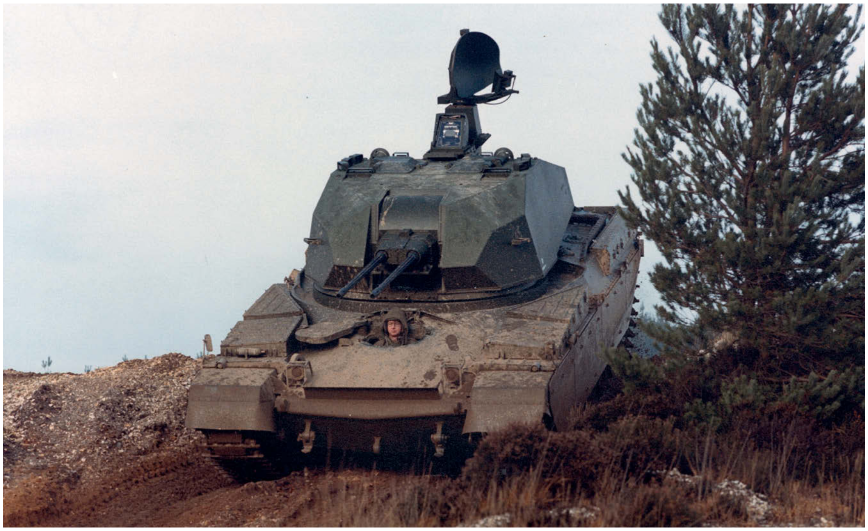
LEFT The definitive model of Chieftain AVRE or CHAVRE was designed and developed by Vickers Defence Systems in conjunction with the Royal Engineers. The CHAVRE is provided with two load platforms capable of deploying Maxi-Pipe fascines and Class 60 Trackway from both the front and rear. These are shown here in the raised position to allow engine maintenance and the crew easier egress from the vehicle. The Ferrari hydraulic on-board crane is visible behind the hamper with the two fascines.

BELOW A Chieftain Armoured Vehicle Royal Engineers takes part in a demonstration at the Land Warfare Centre on Salisbury Plain in October 2005. The AVRE is carrying two Maxi-Pipe fascines for filling anti-tank ditches or streams and features a full-width mine plough at the front. It is towing an AVRE trailer fitted with a Python rocket-propelled mine clearing line charge.





With an effective range of 4,000m, a Chieftain Marksman SPAAG engages a target with its twin 35mm Oerlikon anti-aircraft guns at a rate of 18 rounds a second during a live firing demonstration.



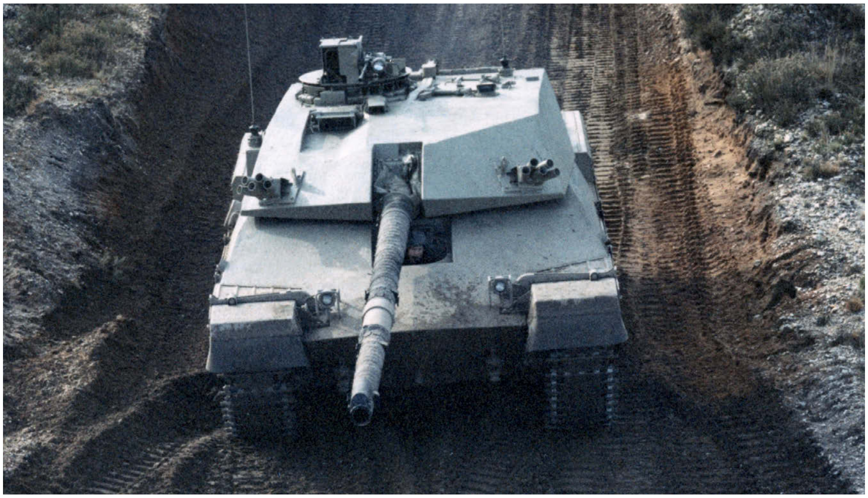
A Chieftain Sabre manoeuvres over broken ground during trials of the twin 30mm anti-aircraft turret. The vulnerability of ground forces to attack from the air, particularly by helicopter gunships, has considerably increased over recent years. Thus, air defence systems are vital to the survival of armoured formations on the modern battlefield. One example is the Anglo-French Sabre turret that was developed as a collaborative venture by the Royal Ordnance Factories and the Electronic Systems Division of Thomson-CSF. It can be fitted to most MBT hulls. Chieftain Sabre is fitted with two 30mm automatic cannon, an Oeil Vert Doppler radar and a fire direction system. A total of 1,300 rounds of ammunition is carried with 600 ready for use against targets out to 3,000m.

CHIEFTAIN MARKSMAN

Developed from 1983, the Marconi Radar and Control Systems Marksman Self-propelled Anti-Aircraft Gun (SPAAG) comprises a self-contained two-man turret incorporating a Marconi Series 400 I/J band radar and two Swiss Oerlikon-Contraves KDA autocannons with 460 fragmentation and 40 anti-tank rounds of nine different types. The rate of fire is 550 rounds per minute to an effective range of 4km (2.5 miles) with 20 to 40 fired at a single target in a normal engagement. The SPAAG has a concerted success rate of 55 per cent, which against fast-moving aircraft flying low at 250m/sec is impressive. Built by Vickers Defence Systems, the Marksman turret was capable of being fitted to most contemporary MBTs including Centurion, Chieftain, Challenger, Leopard, Patton, Vickers MBT and the T-54/55 series. Only seven Marksman turrets were manufactured in 1990 for the Finnish Defence Forces and delivered the next year. They were mounted on the T-55AM chassis as the ItPsv 90 and from 2016 on Leopard 2A4. Of the seven, six are in service and one is used for training.

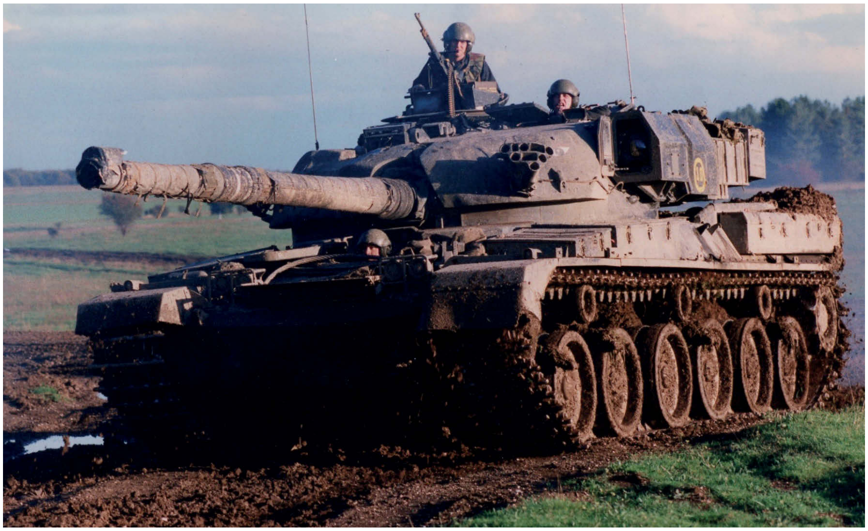
CHIEFTAIN 900

The Chieftain 900 was an export model offered by Royal Ordnance of an updated Chieftain fitted with Chobham armour. The first two prototypes were completed at ROF Leeds in April 1982. Weighing 56 tons, Chieftain 900 gains its name from the



The Chieftain 900 was an export version of the tank configured with Chobham armour and was the final development variant of Chieftain. This model features a Pilkington PE Condor day/night sight for the commander.

900bhp output of its Rolls-Royce Condor V12 900E diesel engine coupled to a Self-Changing Gears TN 12-1000 gearbox with six forward and two reverse gears. The Laser Engineering Hydro-Strut suspension system is available in place of the original Horstmann type for a superior ride and more stable gun platform, particularly when firing on the move. Like late-model Iranian Chieftains on which the tank is based, it embodies greater protection against mine attack. Armament comprises the latest L11A5 120mm tank gun capable of firing the complete range of 120mm ammunition with stowage for 42 charge containers and 64 projectiles: a typical ammunition load being 22 APFSDS and 44 HESH rounds. The fire-control system is dependent on customer requirements but can include the Marconi IFCS of Chieftain, Khalid and Challenger; the simpler Marconi SFCS 600 and Ferranti Falcon, as well as the sophisticated Marconi Centaur FCS. By allowing an extensive range of optional equipment, the total cost to the customer can be tailored to their specific requirements, budget and the capabilities of their crews. The Chieftain 900 was first presented at the British Army Equipment Exhibition in 1982 and was offered on the international market until 1986.



With the setting sun casting long shadows, a Chieftain Mark 11 C of the 4th Royal Tank Regiment returns to its night leaguer at the conclusion of the final exercise conducted by the Chieftain MBT with the British Army on Salisbury Plain in June 1995. During the 1980s, serious consideration was given to instituting CHIRP or the Chieftain Improvement Retrofit Programme. This was intended to enhance firepower and survivability by fitting a new High Pressure Gun and the Improved Computerised Sighting System along with further improvements to the commander's cupola as well as stowage for the Depleted Uranium Round. Improved survivability was to be provided by new armour packages including Stillbrew and Trackmark and by the replacement of the No. 6 NBC pack by the No. 11 Mark 1 and Control Panel No. 15 Mark 1.

CHAPTER 4

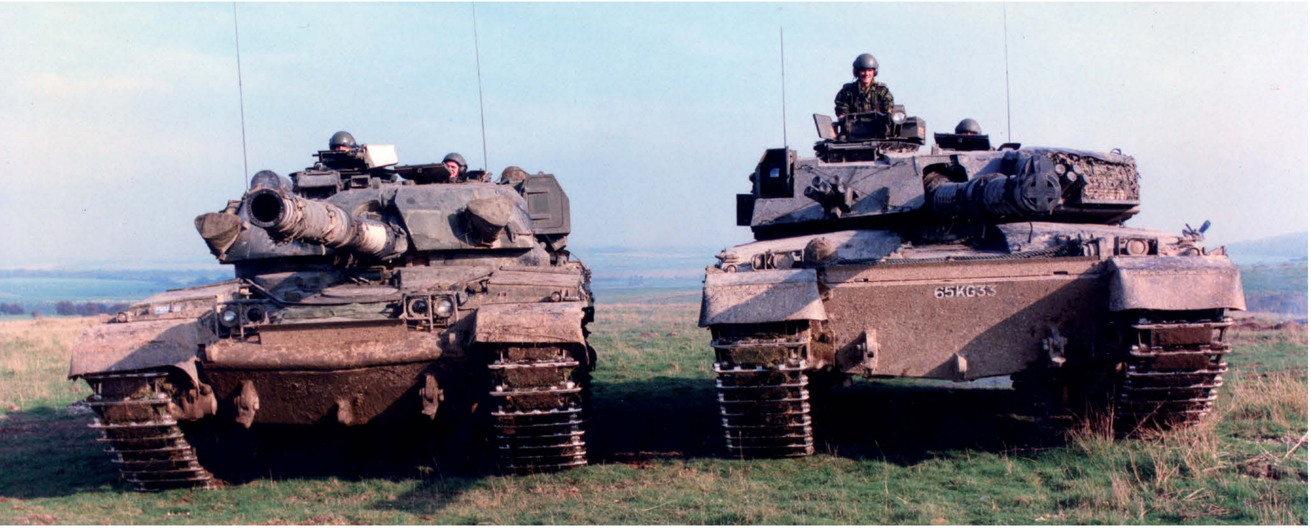
CHALLENGER

DESIGN AND DEVELOPMENT

Tank design is a continuous process and, even before an MBT enters service, concepts and characteristics for its successor are being explored. By 1970, Chieftain MBT was in widespread service with the British Army and, in the following year, the Imperial Iranian Army ordered 780 Chieftains. These models differed only in detail from those in the British Army and all were delivered by 1977. Further purchases of Chieftain were made by Kuwait and Oman, giving Britain a strong tank manufacturing industry throughout the 1970s.

The Arab-Israeli War of 1967 had reaffirmed the importance of the tank on the battlefield and demonstrated that heavy armour in its design was a worthwhile attribute, despite the emergence of HEAT hollow- or shaped-charge infantry weapons and anti-tank guided missiles in ever-increasing numbers. Indeed, some pundits were proclaiming the demise of the tank in the face of the alarming penetrative power of HEAT weapons which use chemical energy to burn through armour. As a rule of thumb, contemporary HEAT warheads would penetrate steel armour to a depth four times their cone diameter. Such designs incorporated cones typically of the order of 84mm (3½in) capable of penetrating up to 340mm (13in) of steel. Soviet weapons of this period were the shoulder-fired RPG-7 with a 73mm (3in) warhead and the man-portable, wire-guided Sagger AT-3 (Malyutka) anti-tank missile with a 150mm (6in) warhead and a penetrative power of 600mm (24in). With 170 missile launchers and 600 RPG-7s in a typical Soviet motor-rifle division, these posed a formidable threat to NATO tanks and any conventional design able to withstand such attack would weigh over 200 tonnes. At the same time, contemporary Soviet tanks such as the T-62 and T-64 had larger main armaments, at 115mm and 125mm respectively, than Western tanks which had standardized on the British L7 105mm gun, except for Chieftain with its 120mm. The Soviets had also pioneered the use of Armour-Piercing Fin-Stabilized Discarding-Sabot (APFSDS) ammunition. This was a highly effective round for killing tanks at the ranges for armoured combat envisaged by Soviet planners.

Faced with such threats, Western designers investigated the properties of different forms of armour with the emphasis on trying to thwart attack from HEAT weapons. During the late 1950s and early 1960s various experiments had been conducted using steel alloy and ceramic laminates which had proved promising but these were

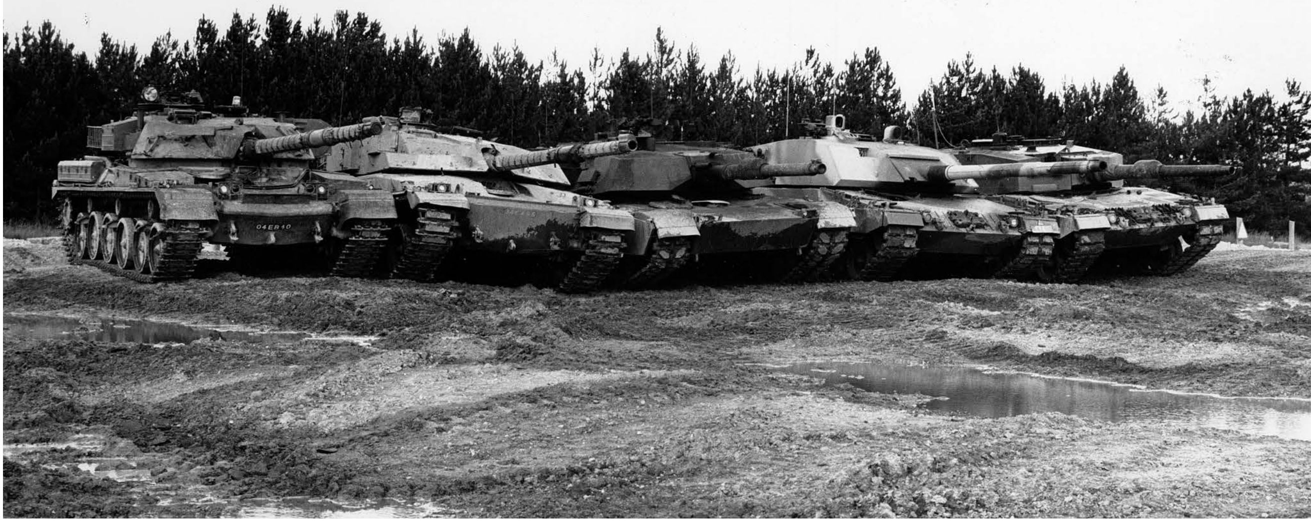


The imposing bulk of Challenger is deceptive since both it and its Chieftain predecessor are of the same width of 3.5m and their height differs by only 5cm. Unfortunately, the two MBTs shared virtually identical fire-control systems based on 1960s technology.

difficult to manufacture and therefore expensive. In Britain Dr Gilbert Harvey, a scientist at the Royal Armament Research and Development Establishment (RARDE) at Chertsey, made an interesting discovery when investigating ways to protect fuel cells inside AFVs. By incorporating honeycomb structures composed of certain materials which were intended to inhibit the explosive nature of the fuel, the effectiveness of HEAT rounds was demonstrably diminished. Further experimentation followed and significant successes were achieved against HEAT attack. A programme ensued which would not only defeat HEAT weapons but be effective also against AP, APDS and HESH projectiles.

After a thorough process of testing and trials, the new composite armour, now known as Chobham, was incorporated in 1971, in an experimental aluminium tank in 1971 designated FV4211 which was based on Chieftain components; Chobham being the name of the town closest to the Military Vehicles and Engineering Establishment (MVEE), formerly RARDE, where it was developed. The construction of the FV4211 coincided with the outset of the US XM-1 programme and, following Anglo-American agreements on the reciprocal exchange of research, details of Chobham armour were passed to the Americans. Trials in the United States demonstrated the remarkable protection afforded by Chobham armour and it was readily incorporated into the XM-1 prototypes being produced by Chrysler and General Motors.

Indeed, the M1 Abrams was to be the first tank to be put into full production with Chobham armour because the development of FV4211 was terminated in 1972. This followed a decision taken by the governments of Britain and the Federal Republic of Germany (FRG) to develop a single design known as Future Main Battle Tank (FMBT) to replace Chieftain and Leopard 1 respectively. The concept of standardization within NATO was much espoused at this time and there were perceived to be attractive economic benefits to be accrued from the sharing of development costs. However, as the abortive US/FRG MBT-70 programme had recently proved, joint tank programmes were fraught with difficulties and so it proved once more. As joint discussions ranged over a wide gamut of options, another war erupted in the Middle East in October 1973 and once again the future of the tank was thrown into doubt.



The Chieftain Replacement Programme represented a radical departure for a tank-manufacturing nation whereby Britain held an open competition from across NATO. Here, various models are paraded during an early comparative assessment with, from left to right, Chieftain Stillbrew, Challenger MBT, M1A1 Abrams, Vickers MBT Mark 7/2 and Leopard 2A4.

Fighting on a scale unseen since World War II, heavy casualties both in men and machines were suffered by attackers and defenders alike with many of the Israeli losses being attributed to the widespread use by Arab forces of Sagger anti-tank guided missiles and the profligate deployment of RPG weapons among their infantry. In fact, less than a tenth of the Israeli tanks destroyed in battle were lost to missiles and most of these occurred during the first Israeli counter-attacks against the Egyptian incursion across the Suez Canal when Israeli tank crews employed cavalier tactics without sufficient infantry support. However, this fact did not emerge until long after the war following lengthy analysis of Israeli tank losses. There was no doubt, however, that there had been some serious shortcomings in the Western tanks employed by the Israelis, not least of which was their capacity to sustain battle damage and continue fighting; an attribute now termed 'survivability'.

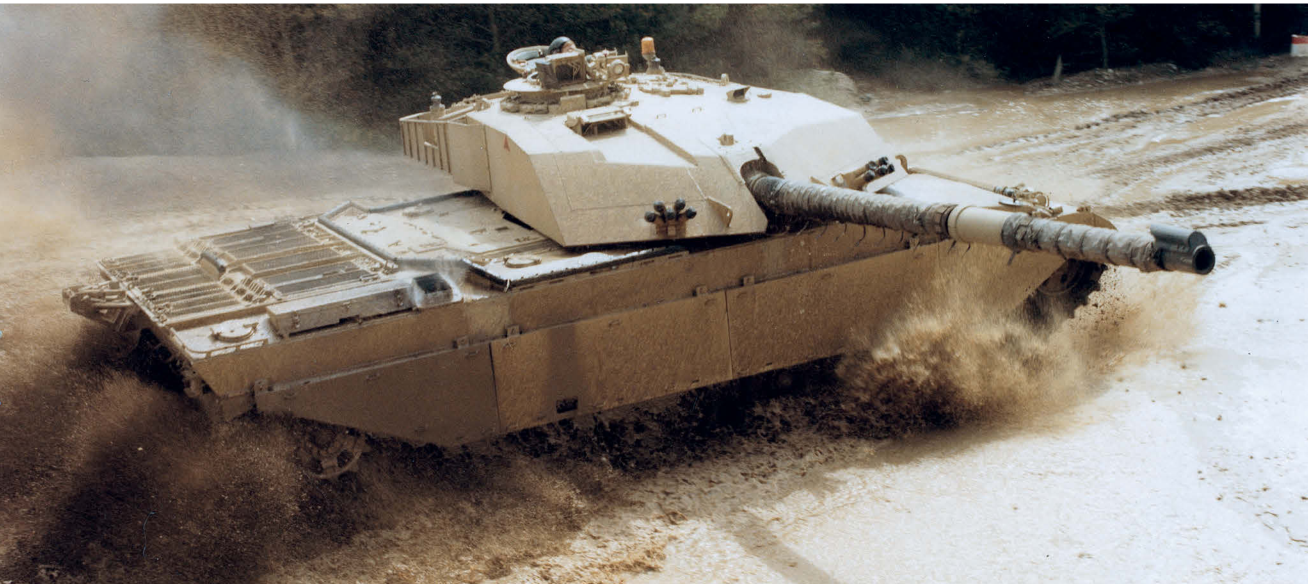
During the October War, the Israeli Army was mainly equipped with American M48 and M60 tanks in the Sinai Desert against the Egyptians, while on the Golan Heights against the Syrians and Iraqis it used the Centurion-based Shot Cal. All these tanks shared the same main armament in the well-proven British designed L7/M68 105mm gun. The nature of the fighting for the Israelis differed dramatically between the defensive battles conducted in the close terrain of the Golan to the offensive operations in the wide-open desert of the Sinai with, at the outset of the war, a lack of customary air superiority.

Invidious comparisons have been drawn between the American and British designs but the M60 did suffer some significant losses with high crew casualties due to two major factors. The first was the use of a hydraulic turret traverse which necessitated high-pressure lines in the crew compartment. If these lines were ruptured when the tank was hit, a highly inflammable mist was sprayed around inside the tank causing terrible burns to the crews should it ignite. The second was the practice of stowing ammunition in the turret bustle. Since the majority of hits occurred in the turret, the ammunition was often penetrated resulting in catastrophic fires. These were lessons learned long ago by the British. The Centurion had an electric turret traverse, even though this meant a more cramped turret and slower traverse, and all combustible ammunition was stowed in the hull below the level of the turret; a practice followed by Chieftain.

For these reasons, British designers felt vindicated in their design philosophy. The Germans however were less happy since Leopard 1 shared an ammunition stowage layout and turret traverse system similar to the M60 but with even less armour protection. A replacement was deemed a priority by the Bundeswehr and it accelerated the development of prototypes of a design that had been formulated following the demise of MBT-70; subsequently to emerge as Leopard 2. However the design study for FMBT continued in Britain and Germany with many interesting and innovative concepts, both conventional and unconventional, being addressed. Eventually the study established the requirement for a conventional four-man tank with a turret, but no agreement could be reached on the timescale for the introduction of FMBT or on the vexed question of work sharing, in particular the division of work to satisfy production orders for foreign customers such as the Iranians. The project was terminated by mutual agreement in 1977.

In the meantime, a further major order for Chieftain had been received from the Imperial Iranian Army in December 1974. The contract provided for the supply of 1,200 Chieftains of an improved version to be called Shir Iran (Lion of Persia); the Ministry of Defence gave the programme the series designation FV4030. In particular the Iranians sought improvements in reliability and power output over the troublesome L60 engine of Chieftain. The design of a new engine was undertaken by Rolls-Royce in conjunction with David Brown Gear Industries for the automatic transmission, combined into a single powerpack assembly. Its proposed configuration however was too large for the existing Chieftain hull so a new vehicle had to be developed to accommodate it.

The design was based on that of FV4211 but with Chobham armour mounted on a steel turret and hull; an L11 120mm main armament with the Improved Fire Control System then being introduced into the British Army and a hydropneumatic suspension system produced by Dunlop. Pending the full development of these features, production continued of a basic Chieftain Mark 5 modified to meet the Iranian specifications with an automatic gearbox, increased mine protection and extra fuel capacity under the designation Mark 5/3(P) or FV4030/1. The first of a batch of 150 was completed in July 1976. Stage two of the FV4030 project was essentially a Chieftain Mark 5/3(P) with a revised rear hull to accommodate the new powerpack. The first three prototypes of FV4030/2 were completed by the beginning of 1977 and it was demonstrated to the Iranians in March under the name Shir Iran 1.

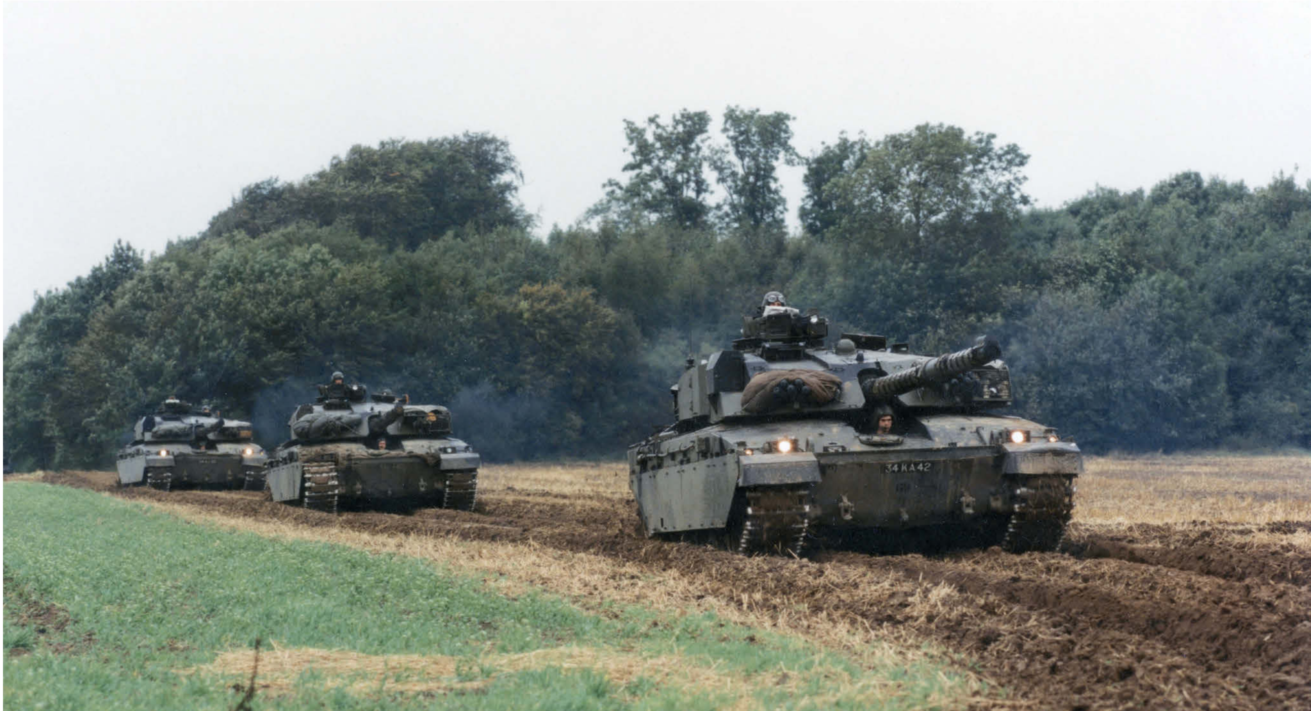


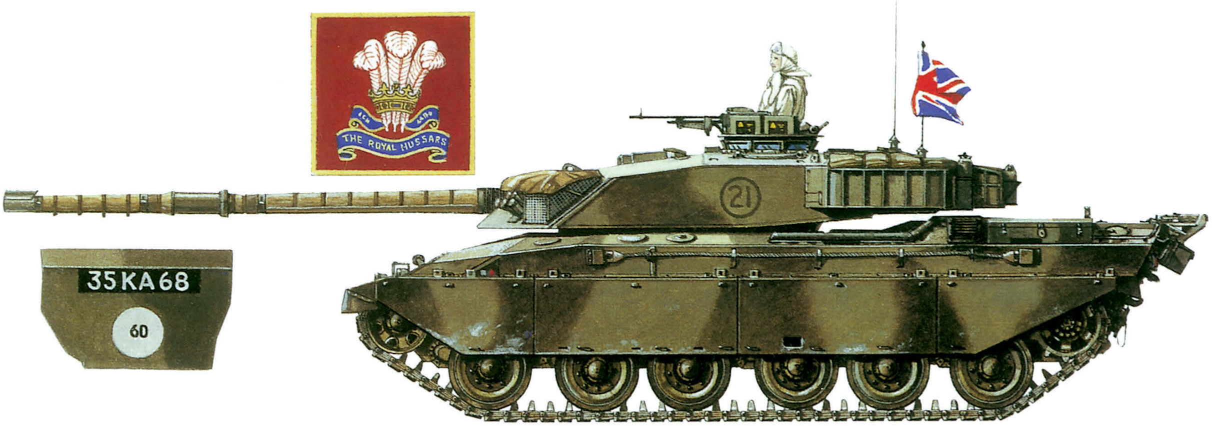
The final model of FV4030 developed for the Imperial Iranian Army was the Shir Iran 2, subsequently known as Shir 2, which was the first to feature the Hydrogas suspension system. One of the reasons for the demise of the FV4211 and the development of FV4030 was the insistence of the IIA on an all-steel tank, because of the problems of stress corrosion cracking associated with aluminium armour.

Problems with the steering units of the TN37 transmission delayed volume production of Shir Iran 1 as well as development trials of the full-specification Shir Iran 2 or FV4030/3, prototypes of which were running during 1977. Production of Shir 1 (the name had now changed) got underway in 1978, with that of Shir 2 being scheduled to start in April 1979, but the fall of the Shah of Iran precipitated the cancellation of the complete contract in February 1979. Fortunately, the Royal Jordanian Army adopted the FV4030/2 as the Khalid MBT and placed an order for 274 in November of that year with deliveries beginning in 1981.

After the collapse of the Anglo-German FMBT project in 1977, Britain was obliged to seek a new solution to Chieftain's replacement. Consideration was given to the purchase of an MBT from another country; the two foreign contenders being the XM-1 and, ironically, Leopard 2. Both tanks were due to enter service in the next few years and the purchase of either would have much enhanced standardization within NATO. However, as the in-service date requirement for Chieftain's successor was not until the late 1980s, it was felt that both designs would be several years old by then and on this basis neither tank would have fully met the needs of the British Army. Similarly, consideration was given to the purchase of Shir 2, at that time at an advanced stage of design, as it was attractive for political and economic reasons as well as enjoying significant commonality with Chieftain to simplify training. Again, like Leopard 2 and XM-1, Shir 2 was being produced to an earlier technological standard and, despite its use of Chobham armour and other technical advances, it did not meet the longer-term operational requirements, particularly in regards to its fire-control system.

For these reasons, development began of a new tank project designated MBT-80. Drawing on the Anglo-German programme it was to be a tank of conventional turreted design carrying a four-man crew. Concept studies addressed the three fundamental areas of MBT design – firepower, protection and mobility. The choice of a main armament proved to be a particularly difficult one between the German 120mm smoothbore gun or a further development of the proven British 120mm rifled gun. The latter was chosen because of its perceived advantages of being able to fire a greater


The first regiment to be equipped with Challenger was the Royal Hussars in late 1983 followed by 2nd Royal Tank Regiment. Here, a troop of Challengers takes part in one of the first FTXs conducted by the new tank during Exercise Lionheart near Hildesheim in August 1984. The crews were quick to appreciate the increased speed and automotive agility of the Rolls-Royce Condor 1,200bhp engine but problems persisted with the David Brown TN37 gearbox for some time, particularly with the steering units. As compared to Chieftain, Challenger was almost twice as fast, while reliability and thus availability was much enhanced.

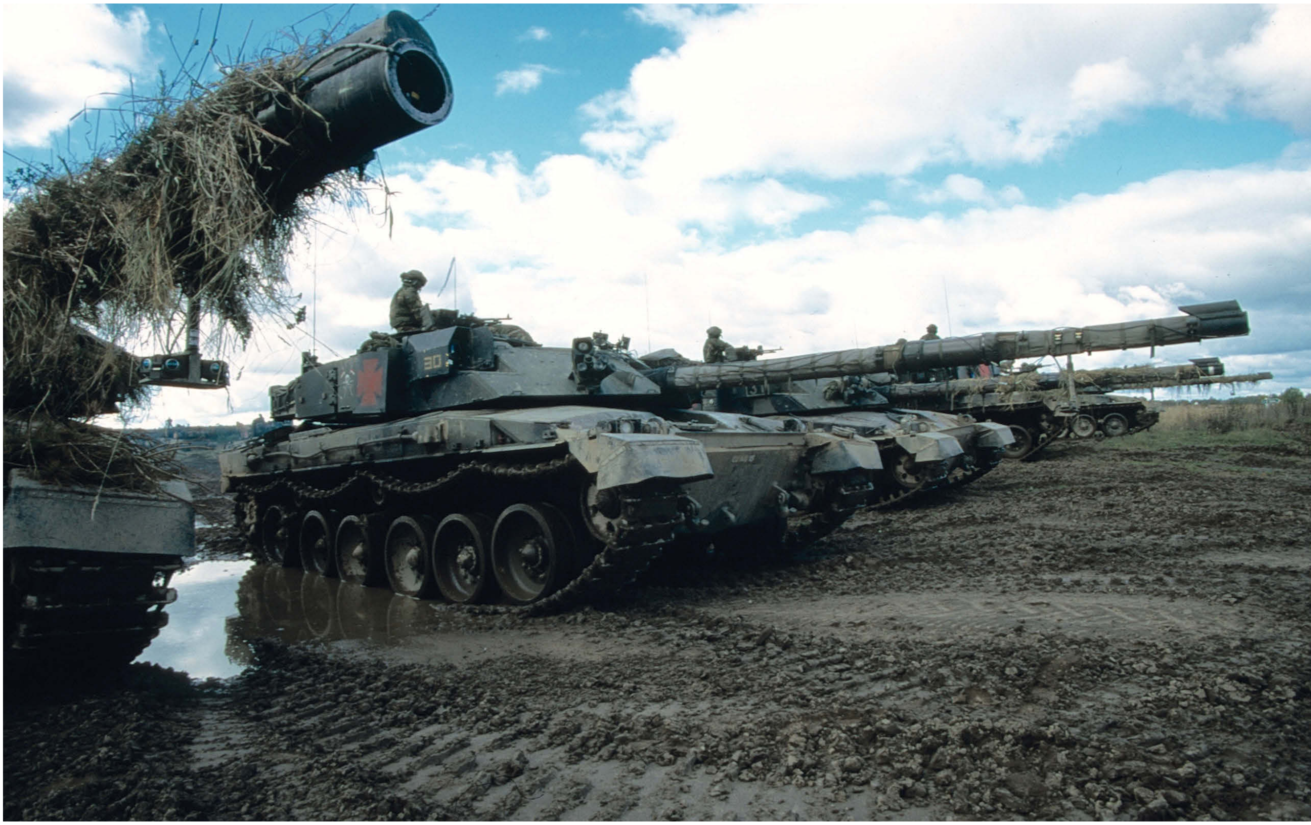


CHALLENGER I MK. 2, C SQUADRON, THE ROYAL HUSSARS, FALLINGBOSTEL, BAOR, WEST GERMANY, 17 SEPTEMBER 1986 (SERGEANT 'PINK' PENKETHMAN)

The Royal Hussars were the first armoured regiment to be equipped with Challenger and this one is finished in the standard British Army camouflage scheme of matt black irregular stripes over the green base colour. It also features low visibility callsigns; in this case 21 within a circle denoting the Troop Sergeant of 2 Troop, C Squadron. The callsign is painted on each turret side and on a plate attached to the turret basket facing to the rear. The regimental crest of The Royal Hussars adorns the door front of the TOGS barbette. On the lower hull front is the bridging classification sign of a small black 60 within a solid grey circle, indicating the vehicle's weight in metric tonnes. Above it is the vehicle registration number 35KA68 inscribed in white on a black rectangle. This is repeated on the rear hull plate beside the right hand light cluster, as viewed, with the letter and number groups arranged vertically. Below the towing bar is a white square with the tank callsign and squadron marking superimposed in black, which can be illuminated at night for vehicle identification by personnel on the ground; for instance during night replenishment. This is common to all Challengers and applies to all the colour plates in this book. It also acts as a convoy distance marker at night. On the left rear hull plate above a jerry can is a first aid box indicated by a red cross on a white solid circle. This Challenger is depicted on Battle Run 9 at the Hohne Ranges near Fallingbostel with Prime Minister Margaret Thatcher in the turret and a Union Flag flying from the radio antenna. During a visit with Chancellor Helmut Kohl, she witnessed a firepower demonstration by a squadron of Challengers and a company of Leopard 2s. The two leaders then each climbed aboard one of their nation's respective MBTs and fired one round each at a target down range: both being successful much to the organisers' relief. Following her visit, the PM maintained a keen and inquiring interest in all matters relating to Challenger and the development of its successor.

variety of ammunition natures. In particular it would be able to fire both fin-stabilized and spin-stabilized ammunition, thus allowing more flexibility in defeating the new types of armour arrays then being introduced as well as provide fire support to the infantry with the superior high-explosive capability of the HESH round.

The tank was to be built with Chobham armour but with increased protection against top and bottom attack. As to mobility, the stated requirement was a power-to-weight ratio of approximately 27bhp/tonne for a vehicle of 55 tonnes which predicated an engine of 1,500hp. The choice of engine was narrowed to two options: a 1,500hp version of the Rolls-Royce CV12 TCA diesel and the Avco Lycoming AGT-1500 gas turbine as fitted in the XM-1 Abrams. There was an influential school of thought that favoured the gas turbine, so no final decision had been made when the MBT-80 entered the project definition phase in September 1978, which was to last approximately two years. A decision concerning the powerplant was due in mid-1979 with the project entering full development by 1981. Development prototypes were to appear around 1983–84 with a design cut-off date in 1985 followed by definitive development models the following year. The in-service date of MBT-80 remained 'in the late '80s'.



A line of Challenger 1 MBTs of the Queen's Royal Lancers equipped with TES prepares for action during Exercise Ulan Eagle 1999. The red Maltese crosses on the side of the turrets indicate enemy forces, as does the deletion of the bazooka plates to alter the basic outline of the tank. In this context the three-letter military acronym TES means Tactical Engagement Simulation and is not to be confused with Theatre Entry Standard.

Even by this timescale it was apparent that the British Army would not field an MBT with Chobham armour until almost 20 years after the appearance of FV4211. However, during 1979 it became evident that MBT-80 was unlikely to enter service until the 1990s and the escalating costs of development were proving considerable. With the Soviet Union producing increasingly capable tanks such as the T-64 and T-72 at the rate of over 2,000 a year, a new tank for the British Army became ever more urgent. Accordingly, in September 1979 it was decided to introduce a limited number of FV4030/3 models adapted to suit British Army requirements but without major modifications so as to speed development and production with minimal additional costs. As a result the MBT-80 programme was cancelled but a research programme continued to identify an eventual replacement for Chieftain.

The new tank was to be called Challenger and an order was placed for 243, sufficient to equip four armoured regiments together with training and reserve vehicles. Between 1980 and 1981, seven prototype Challengers were built which underwent extensive trials at MVEE and with the Armoured Trials and Development Unit (ATDU) at Bovington. As part of the accelerated development programme, more than 100,000km of automotive running were completed to assess the reliability, availability, maintainability and durability aspects, or RAM-D as it was then termed. Initial automotive user trials of two prototypes (V4C1 and V4C2) by ATDU were begun in January 1981 but were soon stopped because of recurring failures of the TN37 gearbox. After modifications, ATDU resumed automotive testing in November with an additional two prototypes (V4C5 and V4C6) in what became known as 'The 7-Pack Trial'.

Throughout 1982 development continued and the problems associated with the clutch design and the hydrostatic steering units were addressed by the two companies involved, David Brown Gear Industries and Commercial Hydraulics. Further automotive trails demonstrated that the Hydrogas suspension provided excellent cross-country performance and high reliability. In October 1982 Exercise Challenger Trophy 2 was conducted by ATDU on Salisbury Plain involving four prototypes on a four-day battlefield exercise. The tanks performed very well and, although Challenger's nominal top speed was 56kph (35mph), it regularly exceeded 70kph (43mph) across the plain. Challenger was accepted for service with the British Army by the General Staff on 14 December 1982 with certain provisos, namely:

Proven solutions had to be found for the problems associated with the following aspects of Challenger:

1. Main engine generator drive
2. Neodymium-YAG Tank Laser Sight
3. Tools and Test Equipment
4. TN37 Gearbox
5. Fightability
6. No.79 Sight
7. Scale of major assembly spares

The first regiment to be issued with Challenger was the Royal Hussars which received their first one on 12 April 1983.

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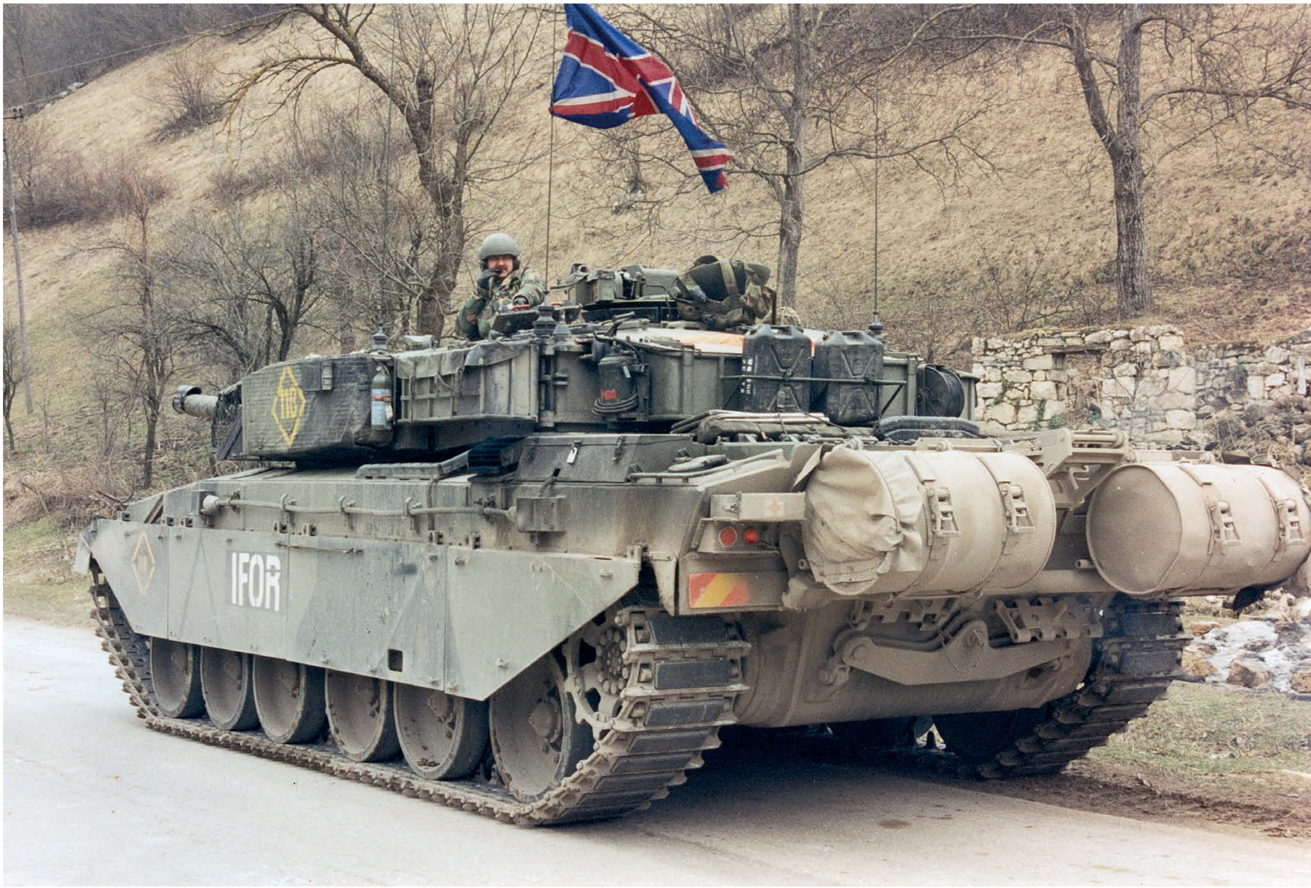
During the training year at BATUS, the temperature range varies from the high 40s° C to well below freezing that is particularly punishing to men and machines, as is the dust, mud snow and ice that comes with the seasons.



The callsign One One Bravo denotes the commanding officer's tank of The Queen's Royal Hussars during a patrol on the road to Klujc during Operation Resolute in Bosnia in 1996. The letters IFOR signify the NATO-led Implementation Force that was deployed for peace support operations in the Former Republic of Yugoslavia.

CHALLENGER TECHNICAL DESCRIPTION

DRIVER'S COMPARTMENT

Challenger was a logical development of the Chieftain MBT with substantial advances in the areas of armour protection and mobility, the latter being the main deficiency of its predecessor. The layout of Challenger was conventional, with the hull of welded construction and sub-divided into the driver's compartment at the front, the turret and fighting compartment placed centrally and the powertrain at the rear. Access to the driver's position was through a hatch in the glacis plate. The driver reclined when closed down and was provided with an armoured periscope situated behind the hatch. The driver's position was central with linked steering levers to each side. Brake and accelerator pedals were normal and a footrest was positioned under the left foot. The speedometer and main engine switchboard were to the driver's right. Mounted low on the right were the GUE (Generator Unit Engine) and emergency gear controls (both difficult to get to when closed down) and, to their rear, the gear selector which operates in a gate with six gear range positions plus neutral. Two hull batteries were located to the driver's left with projectile racks above. A further two batteries and projectile racks were to his right with a stowage pannier above for the driver's personal equipment. By fully lowering his seat the driver could move rearwards into the fighting compartment.

FIGHTING COMPARTMENT

The main armament of Challenger was the proven L11A5 120mm rifled gun as used on Chieftain. The gun had a semi-automatically operating breech with a fume extractor midway along its length. It fired separated ammunition, the charge being contained in a fully combustible bag ignited by a 'Tube Vent Electric'. The projectiles and charges were loaded by hand. The charges were ignited by the electrically fired vent tubes; 14 of which were held in a magazine on the breech ring. Being a rifled gun, a wide range of ammunition could be fired including APDS-T (L15A4); APFSDS-T (L23A1); DS-T (L20A1); HESH (L31A7); HESH practice (L32A5); Smoke WP (L34A2) and Canister (L35A1).

The commander was seated at the right rear of the turret with the gunner forward and slightly below him. The commander had a No.32 cupola with fixed unity periscopes providing all-round vision and a No.37 combined day/night sight giving the commander 10x and 1x unity vision by day and 4x vision by night. The cupola could be traversed independently of the turret and a 7.62mm L37A2 was mounted externally which could be cocked, elevated and fired from under armour.

The gunner's main sight was a periscopic Tank Laser Sight No.10 Mark 1 with a magnification of 1x and 10x. The laser rangefinder was a neodymium-YAG type with an operating range of 300 to 10,000m, with the distance being displayed in both the gunner's and commander's sights. These were integral with the Computerized Sighting System (CSS). Designed by Marconi Command and Control Systems, the CSS integrated information from the laser rangefinder with that of target movement and vehicle attitude from sensors built into the system and automatically calculated the appropriate lay of the main armament. The gun and turret were then driven to the correct position, the gun being stabilized in both axes. Since Challenger was designed primarily to fight from prepared positions covering designated arcs of fire, CSS significantly increased the probability of a first-round hit against moving targets, particularly at long ranges. The system also allowed the gunner to keep targets under close observation while on the move and then make final adjustments for firing at the short halt, the preferred method of tank engagements in the British Army. The tank was also equipped with the Muzzle Reference System which allowed the gunner to check any deviation in the gun barrel alignment with the sights and make adjustments without leaving his position in the tank.

One of the major innovations of Challenger was the introduction of TOGS – Thermal Observation and Gunnery System. The system enabled Challenger to detect, track and engage targets with equal facility by day or night and, being completely passive, without betraying its own position. It was also highly effective in adverse weather and battlefield conditions, such as mist and smoke. The TOGS system has two principal elements – the Thermal Surveillance System (TSS) and the Gunnery Sighting System (GSS). The TSS comprises the actual thermal imaging equipment of TOGS, which picks out any object that radiates heat against the difference in thermal characteristics of its background. Known as the TISH or Thermal Imager Sensor Head, it is mounted within a servo trunnion unit inside an armoured barbette on the exterior of the tank turret. With a dual field of view, the TISH provides a general surveillance and vehicle navigation facility in wide angle and allows target recognition and gun aiming in the narrow angle. The thermal radiation detected by TISH is converted into electrical signals suitable for presentation once they have passed through the Symbology Processing Unit or SPU (pronounced 'spew'), which is the control centre of TOGS. This computer integrates data from multiple sources in the GSS and, in essence, turns what would otherwise be a thermal camera into a gunsight. Positioned adjacent to the gunner's and commander's stations, both Individual Visual Display Units show identical information with graticule, aiming marks and ballistic data generated on the thermal picture for gunnery by either crewman, with the commander having an override facility.

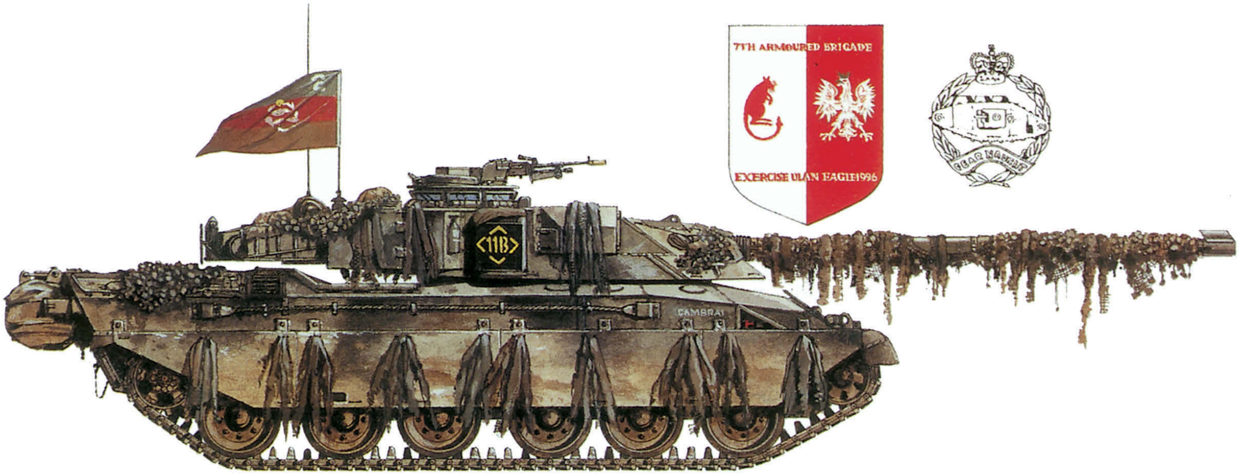
Challenger was the first tank in British Army service to be fitted with Chobham armour, which gave it excellent protection against the HEAT warheads that make up the majority of anti-tank weapons on the battlefield. On Challenger the highest level of protection was provided on the hull and turret fronts, giving immunity against the largest hollow-charge projectiles such as the Russian AT-4 Spigot, which can penetrate 500mm (20in) of conventional steel armour. The armour configuration also gave high protection against kinetic energy rounds. According to US sources, the protection over the frontal arc of both Challenger and the M1A1 Abrams was equivalent to about 1,000mm (40in) of steel armour. While no Challengers were hit by heavy calibre weapons in the Gulf War, seven M1A1s suffered direct frontal hits from tank guns, mainly from the 125mm main armament of T-72s, but no penetrations or crew casualties ensued.

Undoubtedly the most dramatic difference between Chieftain and Challenger was the new tank's greatly enhanced mobility and agility, despite an overall weight of 60 tonnes. Challenger had an integrated powerpack incorporating the engine, transmission and cooling group in a single assembly which could be removed and replaced in under an hour. The powerpack could also be run up on a trolley outside the vehicle for fault-finding and tuning. An auxiliary power unit or GUE provided electrical power for silent watch operation and to assist in main engine starting.

The main engine was a Perkins Engines (formerly Rolls-Royce) Condor V12 TCA diesel engine with a rated power of 1,200bhp at 2,300rpm. Exhaust gas turbocharging and charge air cooling devised by Garrett-AiResearch was employed to maximize power output from a capacity of 26.1 litres, giving Challenger a power-to-weight ratio of approximately 20bhp/tonne. The engine was located at the front-centre of the powerpack compartment with the transmission bolted directly behind it.

The transmission was the David Brown Vehicle Transmission (formerly David Brown Gear Industries) TN37 epicyclic gearbox which allowed gear changes to be made while the gearbox was transmitting power. Four forward and three reverse gears were provided with an automatic controller selecting the optimum gear ratio. Incorporated into the TN37 transmission was the Commercial Hydraulics STN37 steer unit which gave a continuously variable output with hydrostatically transmitted power. This provided Challenger with an infinitely variable turning capability including a neutral turn whereby the vehicle revolves about its centre. Similarly the main brakes, which are of an oil-immersed multi-plate type, are incorporated in the TN37 transmission.

Much of the impressive improvement in the cross-country performance of Challenger was due to the Hydrogas suspension system which provided progressive spring characteristics with highly efficient damping and large wheel deflection, resulting in a much-improved vehicle ride across all types of terrain. The total weight of the suspension system was 25 per cent less than the Horstmann bogie type of Chieftain and maintenance was considerably reduced. Being completely independent of each other, the individual wheel stations are simple to replace; this avoided the vulnerability and complexity of coupled systems, or those using torsion bars which are notoriously difficult to repair following mine damage.



CHALLENGER 1 MARK 2 COMMAND TANK, 2ND ROYAL TANK REGIMENT, 7TH ARMOURED BRIGADE, EXERCISE ULAN EAGLE, POLAND, 12 SEPTEMBER 1996. (LIEUTENANT COLONEL NIGEL AYLWIN-FOSTER)

First and foremost, Challenger was designed for warfare in North West Europe, fighting from successive defensive positions against an armoured onslaught by the Warsaw Pact. Ironically, following the collapse of the latter organisation, NATO battlegroups now undertake field training exercises (FTX) on the territory of their erstwhile adversaries. This Challenger is depicted at the conclusion of manoeuvres on the Drawsko Pomorske Training Area during the first FTX to be conducted by the British Army in Poland, where the crest shown here was adopted. The vehicle is coated in dust which obscures its basic camouflage scheme of black irregular stripes over the green base colour. The vehicle registration number 34KA91 in white on a black rectangle appears on the lower hull front. Beside it is the Union Flag and below it is the Military Load Classification of 70 tonnes indicated by a black 70 on a solid grey circle. The registration number is repeated on the rear hull plate arranged vertically beside the right rear light cluster, as viewed, below which are diagonal yellow and orange reflective hazard markers. Attached to the jerry cans on the rear of the turret basket is the vehicle callsign One One Bravo within a diamond, both painted in yellow, on a black metal plate.

This callsign is also applied to each turret side and signifies the tank of the Commanding Officer. The diamond shape denotes HQ Squadron as is conventional in British armoured regiments. However this is not the case for the other squadrons within the RTR. During the Great War, the original tank units were raised as Companies of the Heavy Machine Gun Corps and then Battalions of the Tank Corps, later the Royal Tank Corps. Subsequently they became Royal Tank Regiments of which eight survived the contraction of the British Army after World War II, each corresponding to the originally lettered battalions of the Great War. Since then, their numbers have been reduced to one but with each amalgamation, the traditions of former units have been preserved. Hence, when Options for Change decreed that 1 and 4 RTR, and 2 and 3 RTR be amalgamated, each remaining squadron assumed the designation of former battalions/regiments. Thus, excluding HQ Squadrons, 1 RTR had A, D, G and H Squadrons, and 2 RTR had B, C, E and F, with the shape of the squadron callsign corresponding to A and D in a conventional armoured regiment. For example a circle in 2 RTR signified E Squadron and many of their tanks carried names that adorned those of E Battalion during the Great War. However, following the change of organisation from Type 50 to Type 38 Regiments, further squadrons have been lost with H and F disbanded respectively although, in 2 RTR, some tank names from the original F Battalion/6 RTR have been adopted by the HQ Squadron, which was formerly known as Nero but has now been redesignated as F Squadron. Thus the titles of all four ancestral Machine Gun Corps companies have been retained.

Such a sophisticated tribal marking system is bound to confuse other units within the British Army let alone foreign military intelligence. The subject vehicle carries the name CAMBRAI which is arguably the most significant battle in the annals of the RTR. Traditionally the CO 2 RTR's tank has been called NOMAD (as a former CO of 2 RTR, Brig. Christopher Hammerbeck, commander of 4th Armoured Brigade during the Gulf War, carried the name NOMAD on his command tank) and that of CO 3 RTR being CAMBRAI. With the amalgamation of 2 and 3 RTR, the latter has been adopted for the CO and the second tank in RHQ is called NOMAD. It also flies the regimental colours of brown, red and green , which were chosen by Major General Sir Hugh Elles, the original commander of the Tank Corps, (2b) with the regimental badge and motto 'Fear Naught' superimposed. With green always at the top, the colours were first flown in battle at Cambrai on 20 November 1917 and, in the words of that great authority on armoured warfare, Major General J F C Fuller, aptly signify the role of tanks on the battlefield – 'from mud, though blood, to the green fields beyond'.

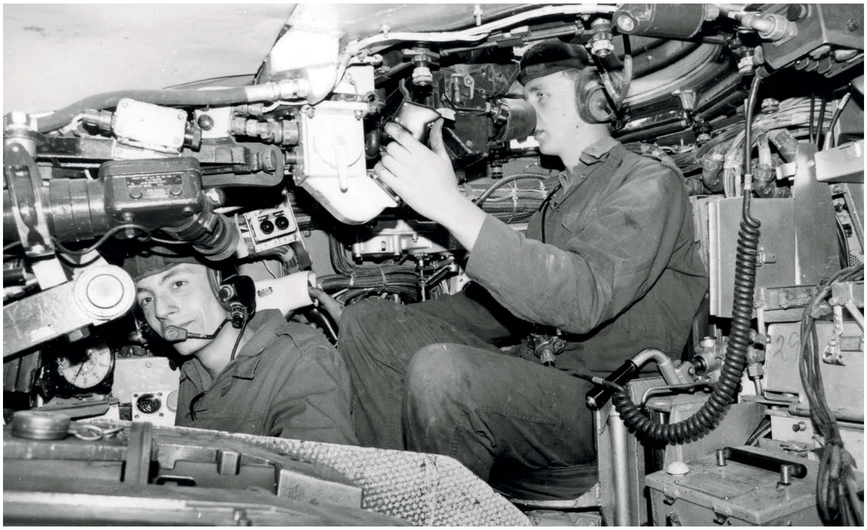
FIRE CONTROL SYSTEMS FROM CENTURION TO CHALLENGER 2

The fire-control system (FCS) on Centurion was developed as a direct result of the experience gained during World War II, and represented a major step forward in making the turret crew as effective as possible. What this really meant when facing a numerically superior enemy was maximising both the rate of fire and the chances of a first-round hit at all ranges – whether or not that hit resulted in a kill was up to the ammunition designers. The key to this was making the commander and gunner, and to a lesser extent the loader, operate as an effective and efficient team. The crew also had to be able to detect a target by both day and night and in poor visibility, establish the criteria for hitting the target, in particular working out the exact range to the target, apply a suitable aim-off if either one's own tank, or the target, or both, were moving, and where necessary, to apply a corrected point of aim if the first round failed to hit the target. This was a complex business and required increasingly sophisticated instruments to be developed and adopted, with a commensurate burden on crew training. It must be noted that Chieftain and Challenger 1 used to all intents and purposes the same basic design of FCS: Challenger 1 was essentially the same inside the turret as Chieftain, and whilst both tanks were improved incrementally, their FCS remained a mid-1960 design. Regardless of type or mark of tank, the major components of the FCS were:

The commander's all-round vision cupola. The commander was extremely vulnerable if he had to poke his head out of the turret in order to control the tank, as the many casualties from all theatres testified. From around 1943 onwards it was British practice to provide the commander with an all-round vision cupola allowing him to stay under armour. The cupola (pronounced by most as cup-ohla and by some as queue-pugh-la) comprised two main elements: a series of periscopes to give him all-round vision, and a powerful sight with which to acquire targets and hand them over to the gunner to engage or, if necessary, engage them himself. These sights had at least the same magnification as the gunner, and in some marks of Chieftain the commander's sight used 15x.

The gunner's main sight. British sights in World War II had been both of poor quality and low magnification, and the crews would inspect captured German Zeiss sights with envy. In order to engage targets at the extreme range of the ammunition, sights had to be improved and so from Centurion the minimum magnification was set at 7x, and later at 10x. Incorporated within the gunner's main sight was a ballistic graticule pattern. This was the name given to the complicated series of aiming marks used to engage targets out to the maximum expected range, based on the capabilities of the ammunition (the performance of ammunition that relies on kinetic energy to defeat armour falls off with range) and the expected distance at which a target could reasonably be expected to be detected and engaged. Graticule patterns became more complex as the tanks developed, and allowed for all types of ammunition (AP, HE and MG) to be fired, as well as allowances made for moving targets and to allow correction of fire (generally for HE and MG only) if the first round missed.

The gunner's secondary sight. As magnifications increased so the external sight windows became larger, and it was realized that there was a high chance of MG fire or HE bursts etc damaging the external components of the gunner's sight, and therefore some form of emergency or secondary sight became a requirement.



One of the significant shortcomings of Chieftain was the complexity of the fire control system with numerous 'black boxes' and the copious electric cabling covering every inch of the interior of the turret. Accordingly, it took a finely trained crew to get the best out of the tank. At the bottom right of the photograph is the Boiling Vessel or BV that is an essential item in all British tank designs to allow the crew to have constant cups of tea.

On Chieftain this comprised a telescope with a very small external aperture to the right of the main armament. On Challenger 1 this was a periscope which was dropped down under armour when not required and only raised by the gunner when necessary. On Challenger 2 this sight is called the Gunner's Auxiliary Sight or GAS and is mounted through the right side of the mantlet. A modified version of the Graticule Pattern is used in all these sights.

Sight adjustment. Sight adjustment is the process whereby the sights are aligned to the gun, giving the best chance of a first-round hit. During World War II sights were adjusted by fixing crosshairs made of cotton thread over the muzzle of the gun, and looking down the barrel from the breech the cross hairs were laid onto a prominent object at a range of around 500 yards, and then the sights adjusted so that they all pointed at the same object. As gun barrels became longer and engagement ranges increased, this became less accurate and so the Muzzle Boresight was introduced. This is a precision optical instrument inserted into the muzzle (which compensates for the tendency of long unsupported gun barrels to droop downwards slightly at the muzzle end) and allows all the sights to be adjusted onto the same point, and if done correctly will lead to extremely accurate and consistent fire. In the late 1970s the Muzzle Reference System (MRS) was introduced onto Chieftain. This system allows the gunner to check that sight adjustment is being maintained as it often 'strays' from true, due to the violent effects of firing and if an error is noticed, allows him to quickly readjust the sights back to the 'true' position.

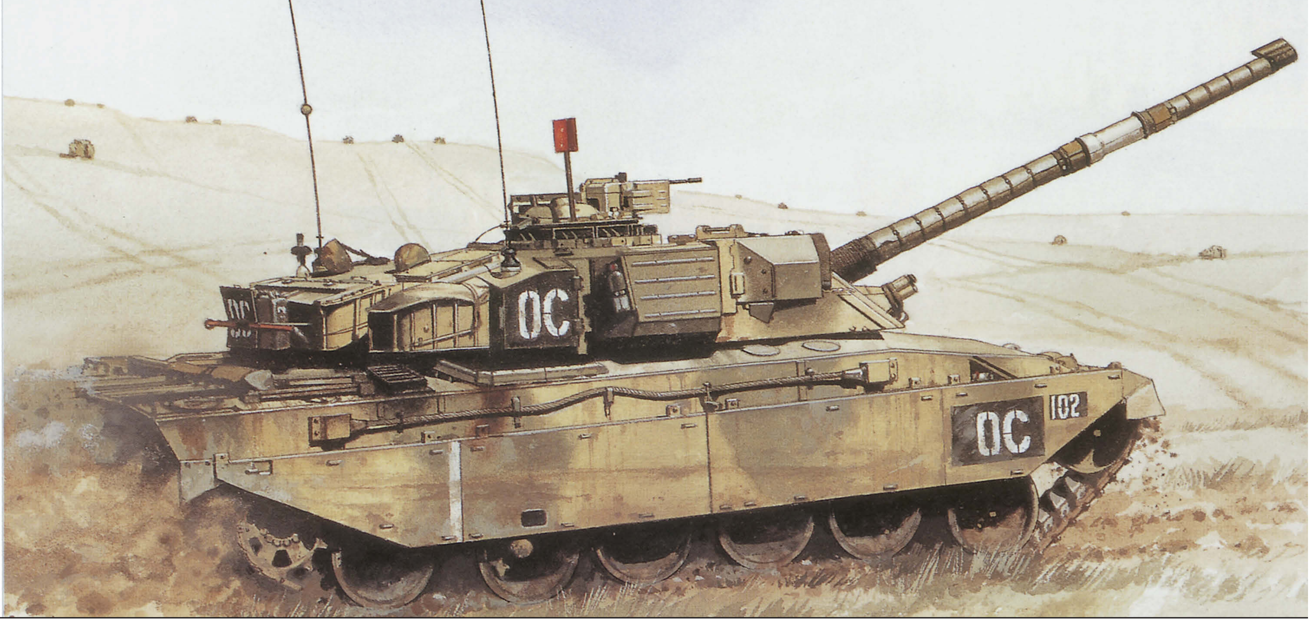
Gun Control Equipment (GCE). GCE is the term used for the equipment provided to allow the turret to move in traverse, and the gun to move in elevation/depression. GCE comprises both electrically powered and manual (hand) equipment. The manual equipment has, over the years, become very much the secondary or even emergency method of moving the gun, and derived from the earliest systems used. The hand controls were a traverse handle and an elevation handwheel, each with their own gearboxes to transmit the movement. The traverse gearboxes all incorporate a two-speed arrangement, for coarse (fast) movement and fine laying, selected by moving the handle up or down to engage the desired speed of traverse. But these were slow and laborious methods of movement, especially as turrets and guns became ever heavier and thus slower to move.

Centurion was the first British tank to incorporate an electrically powered GCE system for both traverse and elevation, and although this metadyne system was relatively unsophisticated in modern terms, it was extremely advanced for its day and was the basis for a series of improvements over four decades which made it possible to develop a system genuinely capable of accurate fire at both moving targets and from a moving vehicle. From the outset Chieftain Mark 1 was fitted with a two-axis GCE controller for the gunner, and from the Mark 2 onwards for the commander as well. These were known as duplex controllers and the commander's incorporated an override facility, in that squeezing in the commander's grip switch would instantly override the gunner's inputs, which was used for both safety and for prioritizing target acquisition. A strange feature of the duplex was that the control was pushed forward/down to elevate the gun, the opposite of what ergonomics would demand. When firing from a static position, most crews preferred to use the GCE to get the sights close to the target, and then used the hand controls for the final fine laying of the gun and correcting of fire.

With the introduction of IFCS into Chieftain (see below) the duplex controllers were replaced with easier to use and much more sensitive items – grip switch and thumb controllers – which solved the problem of elevation/depression in that the thumb control button was moved in the direction that the gun was required to move. The same metadyne system albeit modified and updated was still used, the British doctrine insisting on electrical GCE as it was well known that hydraulic systems were more prone to battle damage and could cause horrific casualties. This continued with the use of much the same system on Challenger 1.

For Challenger 2 a solid-state GCE was developed directly from the Marconi Centaur system as demonstrated on the export Vickers Mark 7/2 MBT. Compared to the previous designs used on Chieftain and Challenger 1, this is a highly responsive electrical system. As before the GCE controls the gun in both elevation and traverse, giving powered control of the turret for both the commander and gunner. One full rotation of the turret under power only takes around 12 seconds, so acquisition of a target should take a maximum of six seconds, with only three seconds required to execute a more realistic line switch of 90 degrees.

On Challenger 2 the design and layout of the controllers used by the commander and gunner were based on Xbox gaming controllers, and the ease of use of these make the gunner's job relatively simple and intuitive. The two controllers, although similar, are not exactly the same, but both have the necessary controls to allow either the commander or gunner to operate as gun director, moving the gun and turret, lasing the target, and completing the engagement by firing and if necessary making corrections. During an engagement the GCE is responsible for positioning the gun and turret in the correct position for firing. A technique known informally as 'hunter/killer' is used, the commander being the hunter and the gunner the killer. The gun controller, most usually the commander at the start of an engagement, lays a small dot generated in his sight onto the centre of the target's mass, and on demand the GCE accurately aligns the gun and turret with this point of aim. The gun will not fire until it is correctly positioned to hit the target, as determined by the fire-control computer. An 'align' facility is used when the commander's primary sight, capable of independent rotation, is operating in independent mode as part of the hunter/killer technique. By pressing his align switch the commander causes the gun and turret to automatically align with where the commander's primary sight is pointing and switches the gunner's primary sight to high magnification, which allows the gunner to take over the shot with the minimum of fuss.

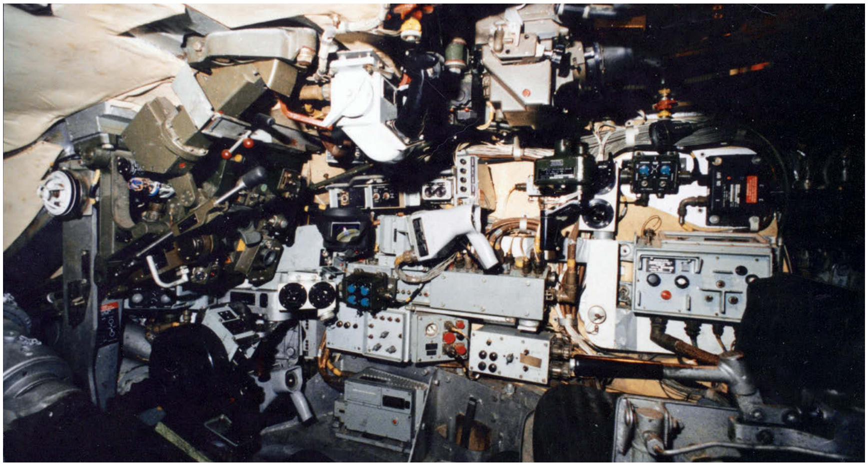


CHALLENGER 1 MARK 2, 1ST ARMOURED SQUADRON, THE QUEEN'S ROYAL LANCERS, BATUS, CANADA, JUNE 1994 (CAPTAIN SIMON VAUGHAN-EDWARDS)

The British Army Training Unit Suffield (BATUS) comprises thousands of hectares of Canadian prairie where live firing of all calibres of weapons allows for the most realistic of field training exercises. In common with all British Army vehicles at Suffield, this Challenger is finished in sand yellow with green irregular stripes. The callsign Zero Charlie is painted with white stencils on black rectangles on each forward bazooka plate and turret side. The callsign is repeated on a metal plate attached to the rear of the turret basket. Forward of the callsign on each bazooka plate is the Zap Code 102, again painted in white on black. At BATUS, each vehicle has its own individual number or Zap Code. The vehicle registration number is 35KA89. The white painted fume extractor is an identifying feature of 1st Armoured Squadron, as is the white stripe down the edge of the rear bazooka plate which also acts as a reminder to the infantry that it is unsafe to be further forward of this line in case the tank fires its main armament. The red metal rectangular device at the commander's cupola indicates that the tank is 'at action'; a white circular one denotes that it is not 'at action' and has no live ammunition loaded in any of its weapons. The callsign Zero Charlie indicates the second-in-command of the armoured squadron and he is further identified, as are troop leaders, by the single tennis ball impaled on the radio aerial; the squadron leader, Zero Bravo, has a radio aerial with two tennis balls - these balls being visible when dust kicked up by the tank obscures the painted callsigns. At the base of the aerial is a rear facing light cluster to aid station keeping at night. Attached to the rear of the turret basket is a metal tube with lights at each end that allows range safety staff to determine in which direction the turret is pointing at night. This tank also carries a fluorescent orange engineer minefield picket stake which is erected on the turret top when the tank is acting in the Intimate Support Troop role to the infantry. On the front of the turret is an inverted V painted in white which is known as the 'forty-fives'. The white V is visible through the commander's sight and is a marker to indicate safe arcs of fire as determined by range safety staff. Depicted during Exercise Gazala at the culmination of The Queen's Royal Lancers' deployment to BATUS in 1994, this Challenger is crewed by B Squadron. Being the mount of the squadron second-in-command, this is a Challenger Control Tank with a particular fit of VRC353 radios.

Other firing instruments. From Centurion to Challenger 1 an instrument known as the Quadrant Fire Control (QFC) was fitted to the gun cradle adjacent to the gunner's left knee. This allowed the firing of HESH and Smoke projectiles at ranges beyond that shown on the graticule pattern (3,200m); the use of the gun in a fully indirect role; and it could also be used as a tertiary emergency method of engaging targets even if the gunner's primary and secondary sights were both damaged. It was a complicated instrument which many crews never fully understood, but when used by a crew who understood the theory it provided an excellent capability.

Linkages. The extensive use of mechanical linkages was one of the reasons why the FCS used from Centurion to Challenger 1 could only be made accurate and consistent to a certain degree. In these tanks, it was the gun which was moved, and



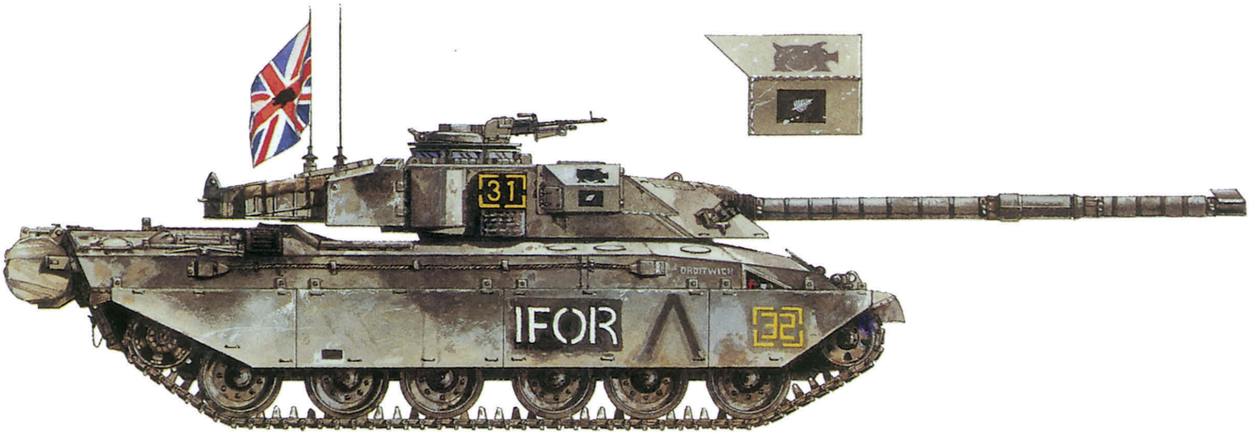
The gunner's and commander's positions in the turret of a Challenger 1 show the complexity of a modern fire control system.

adjustable linkages known as turnbuckles ran from the gun cradle to the gunner's sights, the commander's sight, and the PRI (the Projector Reticle Image, which injected the graticule pattern into the commander's sight, but only when the cupola was in the straight-ahead 'line-up' position") transmitted the movement to the sights. This required the crews, assisted by REME technicians, to spend a lot of time setting up the tanks to fire straight, and although extremely good results could be achieved by a well-set-up tank, it was time-consuming work and establishing the exact reasons why a tank would not shoot straight was as much art as science.

Night fighting. The ability to fight at night, including the accurate use of all weapon systems, conveys a great advantage and British tanks have used an increasingly sophisticated range of devices, often the best in the world. From late Centurions a 22in white light/infra-red searchlight was mounted onto the mantlet as a retrofit, and the design of Chieftain included the provision of a 19in searchlight (officially called a Light Projector), again using both white light and IR, mounted in a box on the left side of the turret. Challenger 1 was designed to accept and, after the first production batch, built with TOGS thermal imaging (TI) system which uses heat sources in the IR range rather than light from the visible spectrum and allows the crew to both observe and engage at night. Indeed, most crews use TOGS as the primary system, both for day and night. It was also retrofitted to later marks of Chieftain, replacing the Light Projector. An enhanced system called TOGS 2 is fitted onto Challenger 2.

Rangefinding. The key piece of information needed to hit a target is the exact range. Estimating the range was likely to introduce errors of between 25 and 50 per cent of the true range, thus a target at 1,000m could be estimated by different commanders to be at between 500 and 2,000m. The first system introduced to assist commanders in establishing target range was the use of a .50-calibre ranging gun, a modified Browning M2 fitted with a rate-of-fire controller that fired the gun in bursts of three rounds, with specially-made flashing-tip ammunition designed to ballistically match the main armament. The crew would fire three-round bursts at ever-increasing ranges, and the first one which either hit the target or went plus (beyond) the target would be used as the start point for firing a main armament round. This was an effective system but the introduction of laser rangefinders made it obsolete.

Laser rangefinders were developed by defence scientists over a couple of decades until by the late 1970s they were mature enough to be introduced onto Chieftain. The gunner was responsible for lasing the target, the range being shown both in his sight and in the



CHALLENGER 1 MARK 3, B SQUADRON, THE QUEEN'S ROYAL HUSSARS, IFOR, OPERATION RESOLUTE, CENTRAL BOSNIA, 11 JANUARY 1996 (SERGEANT POTTER)

The Queen's Royal Hussars (The Queen's Own and Royal Irish) were formed from the amalgamation of The Queen's Own Hussars and the Queen's Royal Irish Hussars in September 1993. Following the peace agreement signed in Dayton, Ohio, on 21 November 1995, the North Atlantic Council authorised the Supreme Allied Commander Europe to deploy Enabling Forces into Croatia and Bosnia-Herzegovina. On 5 December, NATO Foreign and Defence Ministers endorsed the deployment of a multi-national military Implementation Force (IFOR) drawn from all the NATO nations and with additional troops from 16 non-NATO countries. Britain's contribution to Operation Joint Endeavour included a detachment of The Queen's Royal Hussars comprising a small headquarters with two Challengers; two squadrons with 12 Challengers each; a Reconnaissance Troop with eight Scimitar CVR(T) and support elements including two reserve Challengers. The subject vehicle is depicted moving into the devastated area of Mrkonjic Grad on 11 January 1996. Flying a Union Flag emblazoned with a black pig, it bears the callsign Three One in yellow on a black background within a yellow stencilled rectangle on metal plates attached to the turret sides and rear, denoting D Squadron which has provided a complete troop to both A and B Squadrons. The stencilled callsign within a square on the forward bazooka plates shows its attachment to B Squadron. Also on the bazooka plates are the black chevron mutual recognition device, redolent of the Gulf War, and the abbreviation IFOR painted in white on a black rectangle which has been wiped clean for higher visibility.

On the door of the TOGS barbette is the regimental insignia of the QRH and on its top face is the black pig motif which is repeated on the lower hull front below the vehicle registration number 65KG35. Below that is the Military Load Classification of a black 70 within a solid grey circle. The black pig device was adopted as a squadron insignia by D Squadron, The Queen's Own Hussars on its formation in 1993 when the regiment was stationed in Detmold, West Germany. During festivities to mark the occasion, a certain Trooper Gould purloined a large black piggy bank from a local savings bank. The beast was then sawn in half and mounted behind the bar at Hobart Barracks. It adorned virtually every vehicle, item of clothing and artefact in the squadron thereafter. On the side of the TOGS barbette is the white fern leaf emblem of New Zealand marking the affiliation of the 3rd Hussars with 2nd New Zealand Division at the battle of El Alamein, which was granted by General Lord Freyberg VC as commander of the New Zealand Expeditionary Force in World War II. All the tanks in the QRH have names, beginning with the squadron letter, painted in black on the hullsides beside the driver's position. Although some tanks have inspirational names such as DESTINY, most recall regimental battle honours such as DETTINGEN, or place names in the regiment's recruiting areas of London, Birmingham, Northern Ireland and the West Midlands. This tank is named after the town of Droitwich. On the rear mud flaps are high visibility yellow and orange striped hazard markers. Note that the vehicle has a single fuel drum strapped to the rear hull plate on the left-hand side (as viewed) which is used for extra stowage of the crew's belongings, usually a butane gas cooker, food and the essentials to brew a cup of tea.

commander's range readout, which gave the range to the nearest 10m – a massive improvement. Early ruby rod systems were prone to breaking too easily, particularly if the laser was 'flashed' too frequently which led to overheating, but by the mid-1980s the problem was largely solved with the introduction of neodymium-YAG lasers. The computer took a number of inputs ('parameters') from automatic sensors around the turret in conjunction with fixed data entered by the Commander via the Commanders Control and Monitoring Unit and used them all to generate a ballistic calculation before driving the gun to the optimum firing position. Unlike Challenger 2 both CF and Challenger 1 required the crew to fire the gun once the computer has laid the gun.

Computerization. Hard on the heels of laser rangefinding came the first use of a practical computer-based FCS on a British MBT. Known as the Improved Fire Control

System (IFCS), it was introduced into Chieftain in the early 1980s and made a huge improvement in the tank's ability to hit all types of target. The computer took several inputs from sensors around the turret and used them in the ballistic calculation. These inputs included: range, trunnion tilt, gun elevation/depression, turret angle relative to the hull, barrel wear, charge temperature, and air pressure and temperature. All of these, when properly used in combination, meant that the fire-control computer could predict with a great deal of accuracy where the gun had to be laid in order to hit a given target, and injected an aiming mark known as the Ellipse into the gunner's sight as an overlay on the graticule pattern. The same system was incorporated into Challenger 1 where it was known as the Computerized Sighting System or CSS. Challenger 2 used a much more modern version of this computerized system, with the same inputs but linked to the solid-state GCE, which meant that even greater accuracy could be achieved. The biggest difference on Challenger 2 was that instead of the crew moving the gun, with linkages from the gun physically moving the sights, the crew now control computer-generated aiming marks. The GCE moves the gun and turret based on these computer instructions, and is even capable of firing the gun as soon as it is the correct position, a system known as coincidence firing.

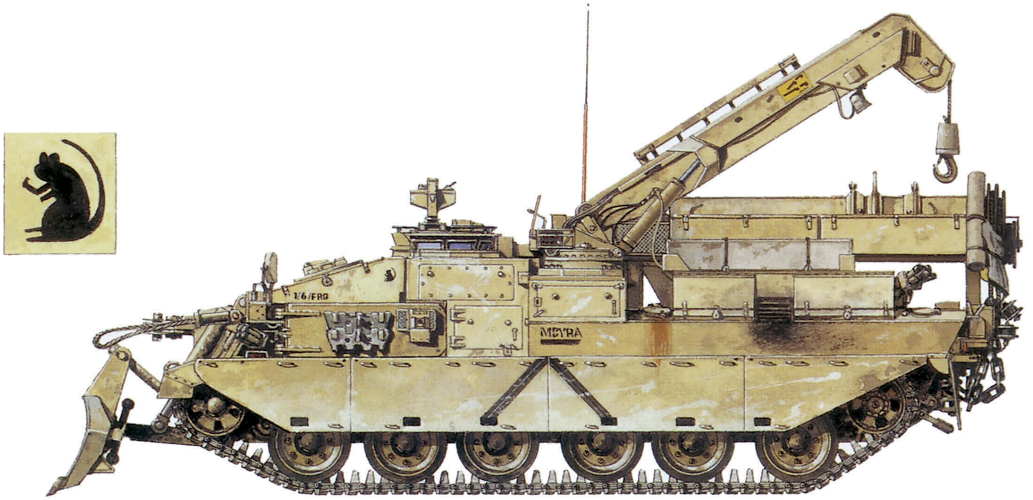
Power generation. Finally, it must be noted that the use of powered GCE, laser rangefinders, computerized systems and night-fighting equipment has meant that the tank must be able to generate the increasing amounts of power necessary to run all these systems concurrently. The use of high-output auxiliary power unit (GUE) and main engine (ME) generators linked to three pairs of large-capacity batteries has allowed this, but at times in the development cycle it was touch and go. If a tank's power generation system is damaged, the commander must decide which systems to run and which to switch off. At times of catastrophic power failure, tank commanders in wartime could access additional power from the hull batteries by bringing them into parallel with the turret batteries by engaging lead sealed lockwire protected circuit breakers and throwing the similarly secure Overriding Master Control Switch to achieve an additional 20–30 minutes of fully operational Fire Control Systems.

CHALLENGER VARIANTS

CRARRV: CHALLENGER ARMOURED REPAIR AND RECOVERY VEHICLE

During the troop trial conducted by the Royal Hussars in 1983, the Chieftain ARRV proved inadequate to support the heavier Challenger. In 1984, the Ministry of Defence invited tenders for the development and manufacture of an ARRV based on the running gear of Challenger. Competitive bids were submitted by ROF Leeds and Vickers Defence Systems. The latter was awarded a fixed-price contract in June 1985 to produce 30 vehicles. By using newly acquired Computer-Aided Design facilities coupled with years of experience in the manufacture of Centurion and Chieftain ARVs, Vickers completed the first CRARRV in August 1987 and the remaining five of the pre-production models in December; a remarkably short development cycle by any standards.

After intensive trials lasting for 14 months, the production run of 26 CRARRVs began in 1989 with four of the pre-production models being subsequently refurbished to production standard to complete the initial contract for 30 vehicles. Several features on the pre-production models, such as the cradle to carry a spare CV12 powerpack over the engine decks, had to be sacrificed to meet the weight and height

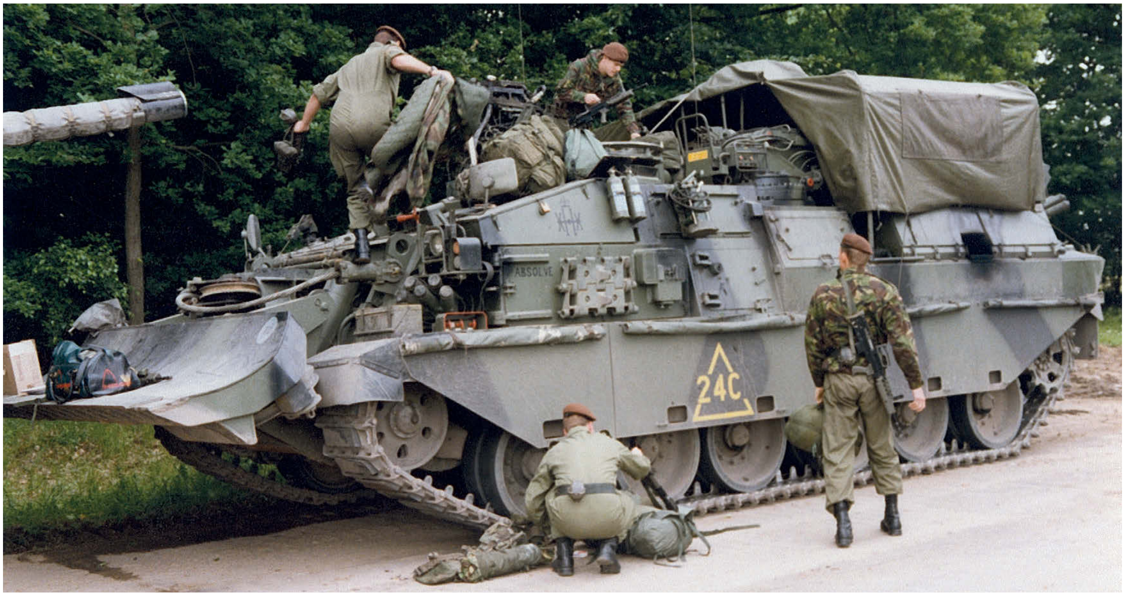


CHALLENGER ARMOURED REPAIR AND RECOVERY VEHICLE, 6TH FORWARD REPAIR GROUP, ROYAL ELECTRICAL AND MECHANICAL ENGINEERS, 4TH ARMOURED BRIGADE, 1ST (UK) ARMOURED DIVISION, KUWAIT, 4 MARCH 1991

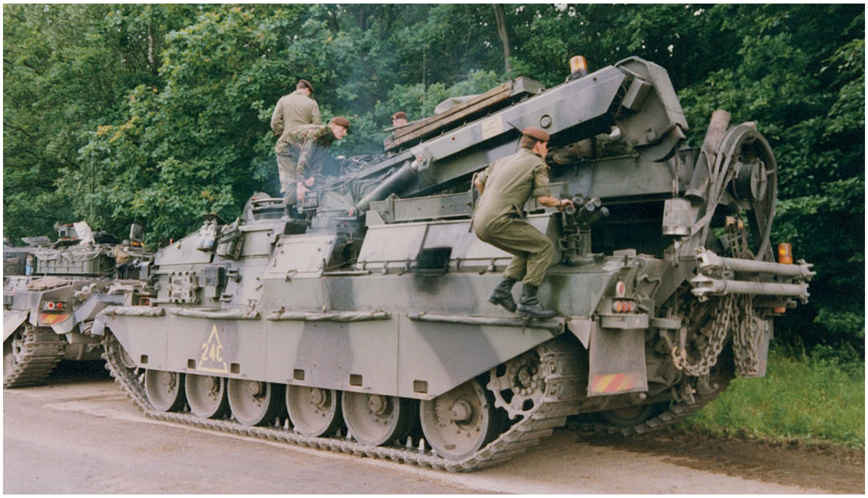
With its Atlas crane aloft, MOYRA, one of 12 CRARRVs deployed to the Gulf, assists in the repair of vehicles soon after the end of the war. The CRARRVs proved highly effective throughout the campaign and, during the actual conflict, were instrumental in towing several casualties to the finish line on the Basra road, on occasion pulling two AFVs at once. The first four CRARRVs, 70KG67-70, CHARITY; BIG GEORDIE!; FAITH and HOPE respectively, were deployed in support of 7th Armoured Brigade. With the commitment of 4th Armoured Brigade and the creation of 1st (UK) Armoured Division, further CRAARVs were despatched to the Gulf with MOYRA 70KG71; BIG ALMA 70KG72; CLARA 70KG73 and MABEL 70KG74 assigned to 4th Armoured Brigade and an additional two, FLORENCE (also known as FLOJO) 70KG75 and BERTHA 70KG76, to 7th FRG of 7th Armoured Brigade. A further two, BARNBOW BELLE 70KG79 and BIG TYKE 70KG80, were held in the War Maintenance Reserve. Many of the names are redolent of the North East and Newcastle-upon-Tyne while the district in the city of Leeds where the vehicles were made gave rise to the name BARNBOW BELLE. Others were named after individuals; for instance, BIG ALMA was in recognition of the dynamic lady in the personnel department of Vickers Defence Systems.

restrictions of bridges in Germany; a spare powerpack was now carried in a Warrior trailer as required. The CRARRV was accepted for service with the British Army in June 1990 with a planned in-service date of May 1991, but this schedule was to be overtaken by the events of the Gulf War.

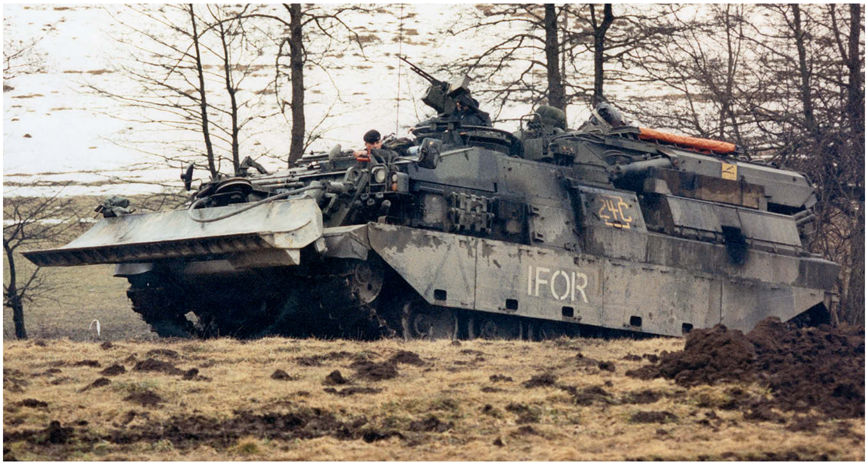
As its designation implies, the CRARRV can be used both for recovery and repair of MBTs in the field. The vehicle carries an extensive range of repair equipment, including welding and cutting equipment and air tools, as well as an Atlas AK6000 M8 hydraulic crane capable of lifting a complete Challenger powerpack. With its TN54 transmission giving much improved manoeuvrability at low speeds and excellent mobility to keep pace with Challenger formations, CRARRV has proved to be an outstanding vehicle from the outset of its service with the British Army. It is capable of towing AFVs of up to 70 tonnes in weight at speeds of up to 30kph (19mph). A further advantage of CRARRV over other support vehicles is that it has been designed to enable a significant amount of MBT repair to be undertaken in the field. Such was its success in the Gulf War that a subsequent order for 50 additional CRARRVs was placed with Vickers Defence Systems, the last of which was delivered in early 1993.

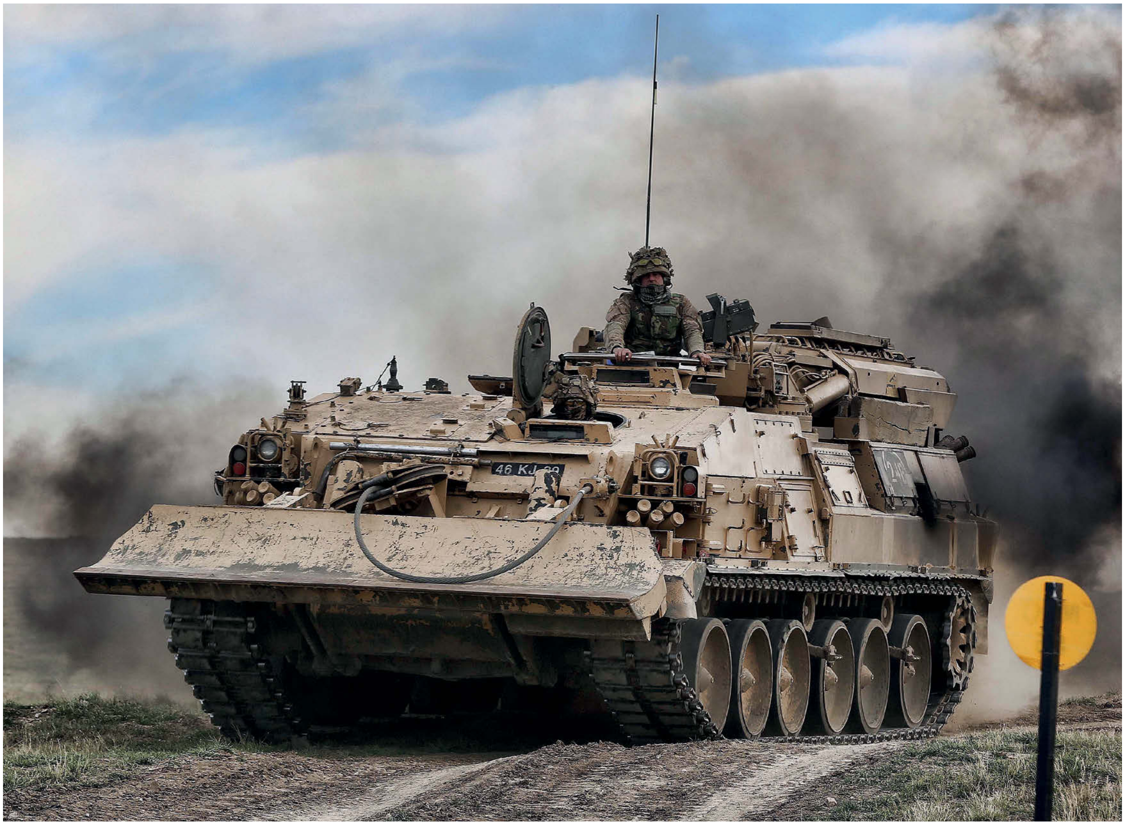


ABOVE AND RIGHT 'ABSOLUTE', a CRARRV of A Squadron, The King's Royal Hussars, is prepared for action prior to an exercise on the Hohne/Bergen ranges in June 1995.



BOTTOM The Challenger Armoured Repair and Recovery Vehicle, or CRARRV, provides immediate Royal Electrical and Mechanical Engineers (REME) support to armoured formations on the front lines. The hydraulically driven, double capstan main winch has a maximum single line pull of 52 tonnes, with 150m of winch rope. The front-mounted blade can operate as an earth anchor, dozer or crane stabilizer. The hydraulically operated Atlas AK6000 M8 jib crane is capable of lifting a complete Challenger 2 powerpack to allow replacement in the field. Nicknamed the Rhino, the British Army procured 81 CRARRVs and this example is serving with IFOR (Implementation Force) in Bosnia during 1996.



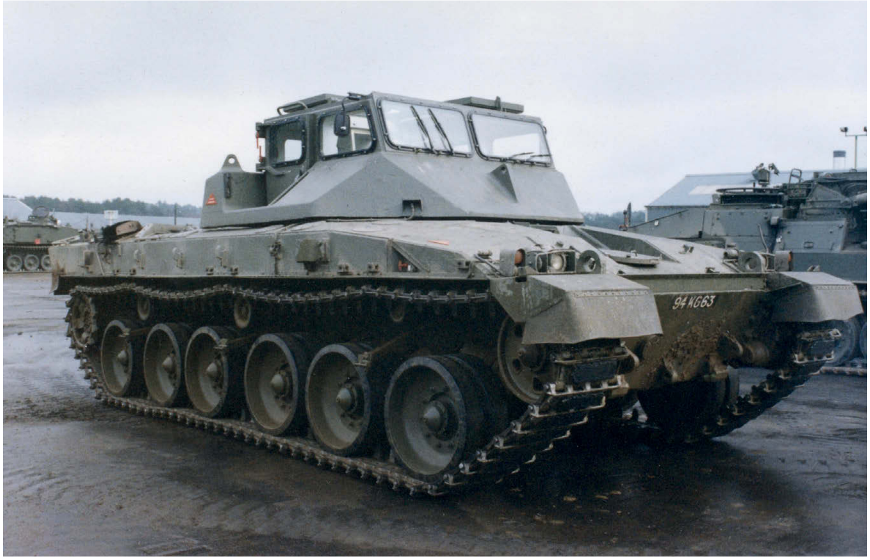


The CRARRV has proved to be a highly successful recovery vehicle and capable of undertaking numerous repair tasks in the field thanks to its integral crane, welding and cutting equipment and air tools. This CRARRV is taking part on Exercise Prairie Storm 4 on 25 October 2014 at BATUS in Canada.

CTT: CHALLENGER TRAINING TANK

In February 1988, the Ministry of Defence placed an order with Vickers Defence Systems for the supply of 17 Challenger Training Tanks. In an £18m fixed-price contract, these were the first purpose-designed training tanks procured by the British Army. As approximately 60 per cent of the total cost of a modern MBT comprises the turret systems, particularly the fire-control system, a specialized training vehicle makes economic sense, and such vehicles have been commonplace in European armies for many years. The first CTT underwent trials at ATDU in Bovington from November 1989. Delivery of the remaining 16 CTTs was made between May and September 1990 and they entered service in 1991. They are used for driver and maintenance training by both the Royal Armoured Corps and the Royal Electrical and Mechanical Engineers.

The CTT uses a complete Challenger chassis but with a weatherproof cabin in place of the turret. The cabin houses the driving instructor and a number of students. Since the CTT is weighted to the same as Challenger MBT, its driving characteristics are identical. Furthermore, the instructor has duplicate controls for safety reasons. He can not only monitor the performance of the student driver, but also inject automotive faults into the driver's instrument panel, such as low oil pressure, low coolant level or a blocked air filter, to see how he reacts. The driver is also provided with a simulated gun position indicator so that he does not wrap the imaginary gun around a tree or lamp post: again, this notional gun position is controlled by the instructor. The latter can also stop the CTT in an emergency by means of separate brake controls and an engine cut-out switch.



The first purpose-built driver training tank for the British Army was completed and delivered by Vickers Defence Systems in 1990. The 17 Challenger Training Tanks or CTT provide realistic yet cost effective driver and maintenance training for both the Royal Armoured Corps and the Royal Electrical and Mechanical Engineers.

CANADIAN ARMY TROPHY 1987

By May 1985, the Royal Hussars were fully equipped with Challenger. Meanwhile, the second armoured regiment to be converted to the new MBT, 2 RTR, received its first Challenger in late 1984. The next two armoured regiments scheduled to be converted were the 17th/21st Lancers (17/21L) and the Queen's Royal Irish Hussars (QRIH). In June 1984, the Ministry of Defence placed an order for an additional 64 Challengers which was enough to equip a fifth armoured regiment in BAOR.

There were reservations in certain quarters about the new tank concerning the adequacy of its fire-control system, which was almost identical to that of Chieftain, which was in turn based on early 1960s technology. Inevitably comparisons were drawn with other MBTs then in full-scale service, such as the M1 Abrams and Leopard 2. This was confirmed following the Canadian Army Trophy of 1985 or CAT '85. Open to all member nations of NATO in the Central Region, the competition was intended to improve the overall standard of tank gunnery within the alliance. However, over the years, it had assumed the character more of a gladiatorial contest with unhappy connotations of national superiority; notwithstanding the commercial kudos attached to the manufacturer whose tank won the competition.

Unfortunately for the British Army, the Royal Scots Dragoon Guards mounted in Chieftain came last in the CAT '85 competition. Widely regarded as one of the most proficient armoured regiments within the Royal Armoured Corps, the SCOTS DG were longstanding users of Chieftain and had come second in CAT '83. The result was all the more disappointing as they were firing on home territory at the Hohne Ranges. There were no doubts in the minds of the SCOTS DG where the problems lay. Improvements had to be made to the fire-control system to improve engagement times as well as providing more extensive technical support for the competition. They also recommended that a regiment be selected as soon as possible for the next CAT and that the crews be drawn from across the regiment rather than a single squadron.

In fact, the latter had been addressed when, based on excellent gunnery results achieved in 1984, 2 RTR was chosen to represent 1(BR) Corps for CAT '87 in time to witness CAT '85. The regiment was thus able to lay careful plans that autumn and devise selection procedures to concentrate the necessary talent. Mindful of the implications another disappointing performance would have for the prestige of the British Army and its equipment, the then Chief of the General Staff directed that Challenger be fielded for the next competition. The inherent limitations of Challenger were acknowledged, and the overall aim was one of damage limitation: Challenger could not be expected to win but hopefully would finish among the weaker M1 and Leopard 2 platoons. Throughout 1986, 2 RTR geared gunnery training towards the objectives of CAT '87 and the annual firing in July was used to select competition crews from across the regiment. They were also able to influence timely decisions affecting equipment enhancements deemed necessary for CAT '87 including early procurement of the Improved Computerized Sighting System (ICSS); albeit in prototype form, which in preliminary trials had suggested that engagement times could be halved compared with IFCS.

Following CAT '85, the Committee of Control again tried to eliminate the gladiatorial aspects of the competition and the participating nations were asked to submit proposals to this end. After much discussion and horse-trading, a revised set of rules was promulgated in January 1986; however, the rules also decreed that each nation must select its entrant from one of two units decided by a random draw held ten weeks before the competition.

Painted in the characteristic green and yellow camouflage scheme employed at BATUS or British Army Training Unit Suffield, a Challenger 1 of 1st Armoured Squadron thunders across the prairie during a 'Medicine Man' exercise in 1994.

This produced a considerable problem for the British Army as its options for the second regiment were strictly limited. Of the 13 armoured regiments, six were equipped with Chieftain which ruled them out while two (17/21L and QRIH) were converting to Challenger but neither had TOGS, which was considered vital for target acquisition on the heated target displays at Grafenwöhr, the range where CAT '87 was to be held. The only other contender was the Royal Hussars, which had a squadron with Challengers fitted with TOGS, and the further advantage of being co-located with 2 RTR. However, the Royal Hussars were committed in 1986 to BATUS in Canada which entailed converting back to Chieftain when they should be training on Challenger/TOGS for CAT.

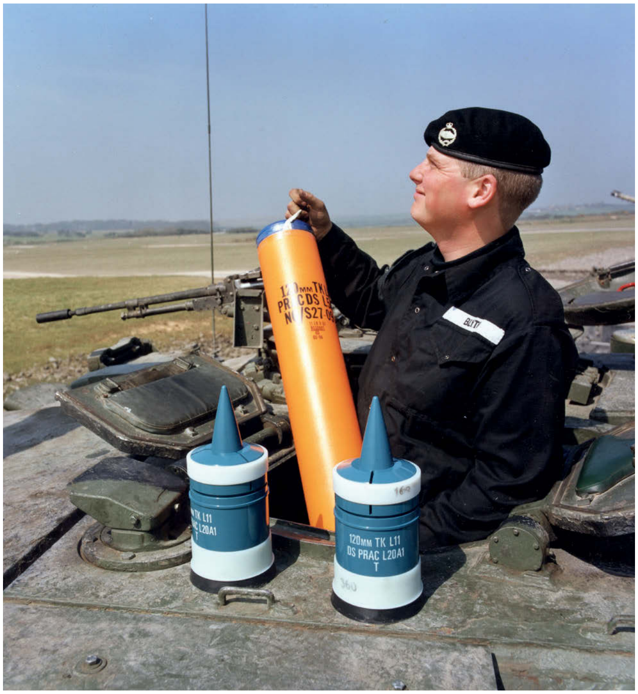
Meanwhile, 22 Challenger MBTs with TOGS (36KA26-44) were specially prepared to provide each contending squadron with new tanks built to exacting quality assurance standards. These were diverted from the production line, resulting in delays to those regiments converting to Challenger. They also incorporated several modifications fitted solely for CAT. Besides the ICSS, these included a finely tuned Tank Laser Sight; a Chase modified loader's firing guard; a less cluttered graticule in the gunner's sight, a revised loading mechanism and an alternative commander's sight with 15x magnification incorporated into a No.21 Cupola – all intended to aid target acquisition and reduce engagement times.

The tanks were fully prepared by the end of October 1986 but because of their autumn commitments neither contending squadron (Badger Squadron of 2 RTR and B Squadron of the Royal Hussars) was able to take up the offer of two days' familiarization on the competition range at Grafenwöhr before it was placed in quarantine on 1 January 1987. Severe weather during February and March restricted training further. On 1 April the final entrant was chosen when the Royal Hussars were drawn out of the hat. Fatefully being the less advantaged of the two regiments, the best-laid plans made in the wake of CAT '85 were completely undermined.

Following the selection of the Royal Hussars, all training resources were concentrated on B Squadron, which set up permanent camp on Battlerun 9 at Hohne. This was laid out to represent the competition range but without any knowledge as to how the targets in the actual competition were to be presented. With increasing familiarity with the complexities of ICSS, some respectable results were achieved. Thus, when crews deployed to Grafenwöhr for a 'mini-CAT' competition on a representative range in May, they compared favourably with the eventual American winners in the M1 and the Canadians in the Leopard CA1. It was at this stage that B Squadron, following the example of other teams, enlisted the services of an acclaimed sports psychologist to help prepare the crews for CAT '87. Imperceptibly, the original directive of the CGS of damage limitation was being forgotten. Under the tutelage of the sports psychologist, the ethos of winning became paramount and with it an exclusive elitism emerged among the competition crews who now adopted colourful cravats and badges while messing separately from support personnel. Within a short time, Hohne witnessed the spectacle of British tank crews humming mantras and dropping ping-pong balls onto each other's stomachs to enhance inner awareness.

On 5 June, B Squadron of the Royal Hussars deployed from Fallingbostel to Grafenwöhr; a distance of 700km (435 miles). The competition lasted from 15–19 June with each team being required to make three battleruns; one for each troop or platoon. The run consisted of three bounds with firing taking place while static on these and on the move between them. Targets were at ranges between 800 and 2,000m. A successful engagement depended on individual tank accuracy and the rapid acquisition and allocation of targets. The objective was to hit the maximum number of targets but, with almost equal points being awarded for time of engagement, a very high premium was placed on speed. Each tank carried ten rounds of main armament and 250 rounds of machine-gun ammunition. The three-tank troop was required to hit 24 targets with main armament and knock down 60 falling plates arranged in groups of ten; for four-tank platoons it was 32 targets and 80 falling plates which statistically is marginally more difficult. A theoretical maximum of 22,600 points could be scored by each troop or platoon based upon the targets hit, the time required and a bonus for unexpended ammunition.

Analysis of the performance of the Royal Hussars during training demonstrated that, in their modified Challengers, crews had the potentiality to achieve 22 hits out of 24 in a mean time of about 14 seconds to achieve scores of between 16,500 and 17,500; exactly what was required for damage limitation. Once again luck did not favour the British as the Royal Hussars were chosen to fire on the opening run of the competition with no knowledge of the course, whereas all the other teams could watch and assess the targets and terrain. Their second run was to be on Wednesday and their third on Friday – the final day of the competition. It was decided that 3rd Troop should open the batting followed by 1st Troop on Wednesday, considered to be the weakest in the squadron, and 2nd Troop, who had shown the strongest performance, on Friday.



The L11 120mm tank gun uses three-piece ammunition with the projectile and propellant loaded separately. This system allows safer stowage of propellant charges and high explosive shells below the level of the turret ring where they are less likely to suffer catastrophic secondary explosion following penetration of the turret. This trooper of 1st Royal Tank Regiment is loading a full propellant charge into the turret with a pair of 120mm Discarding Sabot practice rounds to hand.

In the event, 3rd Troop's first run was entirely consistent with the predictions and, by firing methodically and accurately, 22 out of 24 targets were hit at an average time of 13.64 seconds giving a perfectly satisfactory score of 16,606. However, there had been mechanical problems with the presentation of some of the targets and 3rd Troop were offered a re-run on condition they sacrificed their original score. Having got a feel for the range, the squadron leader believed they could do better on a re-run although it would not take place until late on Wednesday. This meant that in effect 1st Troop was to open the batting which put them under considerable pressure as the Abrams and Leopard 2 teams achieved increasingly impressive scores.

Unfortunately, so it proved on the Wednesday when accuracy was sacrificed for speed, and although 1st Troop achieved the fastest average engagement times of the four British runs at 11.7 seconds, seven targets were missed. With the troop communications being broadcast over the public address system, it became apparent that troop control had failed – one commander urging his crew to be faster immediately after a successful three-second engagement! With a mediocre score of 14,306 by 1st Troop, 3rd Troop tried to better its performance of Monday but to no avail. Again, speed was the enemy of accuracy, causing too many errors of lay and only 18 targets were hit compared to 22 on their previous run, giving a score of 14,260 – the lowest in the competition so far.

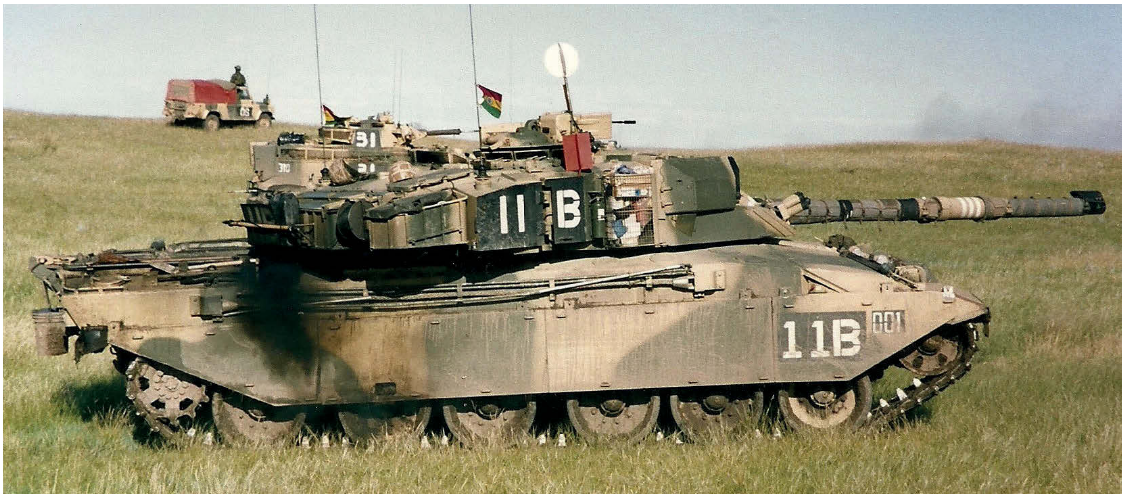
By Friday, the Royal Hussars were lying at the bottom of the score sheet by a wide margin and were facing their last opportunity to redeem themselves. 2nd Troop was therefore under intense pressure. All began well but during the move from the first bound disaster struck. The loader in the troop leader's tank, having put a projectile into the breech, had to deal with a broken belt on the coaxial machine gun while firing on the move. Having tried but failed to resolve this problem he returned to the breech, when the vent tube magazine fell off. By the time he had fixed this he was confused and loaded a second projectile, jamming the breech – such are the disadvantages of three-piece ammunition. Despite hitting 19 targets out of 24, 3rd Troop could only achieve a meagre score of 13,673.

When compared with the winning team's score of 20,490, which incidentally is the highest ever in a CAT competition, the result was dismal. Beside himself with rage, the C-in-C BAOR departed in his helicopter. His entourage followed. By lunchtime, the highest-ranking British officer remaining was a subaltern of the Blues and Royals tasked with public relations – not an enviable task in the circumstances. As for the Royal Hussars themselves, they were completely devastated but to their credit none blamed the tank itself. Within weeks, not a single troop leader in the CAT team remained in the British Army.

These figures, however, do not fully reveal the complete superiority of those tanks in the competition equipped with a commander's panoramic sight and gunner's stabilized sight over those without when firing on the move. Abrams and Leopard 2 were twice as likely to hit a target, at 88.5 per cent compared to 43.5 per cent for Challenger. The ICSS fitted to the CAT-modified Challengers incorporated an Independent Aiming Mark in the gunner's sight which attempted to replicate the effect but was not nearly as efficient as true stabilization. This and a host of other factors touched on in this account militated against Challenger being able to shine during the CAT competition.

It is a measure of the success of the NATO alliance in maintaining the peace for over 40 years that the Canadian Army Trophy assumed such importance and came to be regarded as a valid operational test. Thankfully, there had been no wars to measure the relative effectiveness of all the current generation of MBTs, but no manufacturer was slow to trumpet the success of its product following a CAT competition. The ever-escalating cost of military equipments has made foreign sales a necessity in any weapons procurement programme. Despite vigorous sales campaigns in the Middle East in 1983, 1985 and again in 1987, the latter coinciding with CAT '87, there have been no foreign purchases of Challenger.

During the preparations for CAT '87, a total of 6,585 rounds of DS/T 120mm ammunition was expended at a cost of approximately £1.9m. Competition crews each fired in excess of 500 rounds during training which was well beyond the 134 permitted by the rules, but the stakes were high and the cost represents approximately the price of one tank; money well spent if foreign sales had ensued. As to the rules of the competition, each nation interprets them as they will; be it the grizzled gunnery instructor who appears in the turret of a young conscript crew or those who surreptitiously video the targets and layout of the competition range after it has been placed in quarantine in order to re-programme the tank gunnery simulators for their teams. But no amount of splenetic apologia in the letters column of The Daily Telegraph could escape the fact that the complexity and poor ergonomics of the turret system of Challenger led to unsatisfactory human performance on the day.



The zap number 001 and the radio callsign One One Bravo indicate that this Challenger belongs to the officer commanding the armoured squadrons at BATUS with the regimental pennant signifying The Royal Dragoon Guards. The white circular device above the commander's cupola means that the tank's weapons are unloaded whereas the opposite is the case when the red indicator is mounted.

Needless to say, answers were sought from on high, from the C-in-C BAOR to the Prime Minister. It was decided to hold a comparison shoot between Challenger, Abrams and Leopard 2 witnessed by Lord Trefgarne, the Minister for Defence Procurement. For the sake of fairness and accountability, soldiers from 2 RTR were trained on each of the foreign tanks with Sergeant Amos Brearly and Corporal Dave Glen on the M1A1 Abrams and Sergeant Andy Hope as the gunner of the Leopard 2, while Sergeant Bob Soames commanded the Challenger with an all-RTR crew. The shoot was held at Range 1 on Bergen Hohne. Each tank had ten rounds of main armament ammunition: six to be used for static-on-static engagements and the rest for firing on the move against static targets. For speed of engagement, the Challenger matched the M1 and beat the Leopard 2 by one second against the static targets, with all tanks achieving 100 per cent hits. On the move, the M1 and Leopard 2 achieved 100 per cent hits while Challenger hit two out of four.

The shoot was repeated at Sennelager but Challenger was only allowed to use SH/P (Squash Head/Practice) rounds due to the safety limitations of the range template. This was a distinct disadvantage for Challenger because of the much slower velocity of the practice ammunition, but all three tanks achieved 100 per cent hits in static-to-static engagements. However, Challenger did not fare so well on the move and only attained mobility kills. There is no doubt that Challenger performed more than adequately, given that it was designed to engage enemy armour from prepared defensive positions, killing at long ranges before withdrawing to new positions. Firing on the move was never a priority for the British Army as it was in the Canadian Army Trophy. Furthermore, the two American master gunners that trained the RTR crew on Abrams observed that the L11 120mm rifled gun had a significantly greater terminal effect against the tank hulk targets than the Rheinmetall 120mm smoothbore gun of both the M1A1 Abrams and Leopard 2.

CHALLENGER TO CHALLENGER 2

At the beginning of 1987, it was still the intention of the British Army to retain a mixed fleet of some 1,200 Chieftain and Challenger MBTs until the turn of the century when it was anticipated they would be superseded by yet another Anglo-German collaborative venture which was begun in the early 1980s. This project, known as the FMBT 2000,

In 1999, almost the entire British Army fleet of Challenger 1 MBTs was sold to the Royal Jordanian Army: 400 gun tanks and two Challenger Training Tanks. Renamed Al Hussain after the 7th-century Islamic revolutionary leader, the MBT was issued to the premier armoured unit of the Royal Jordanian Army – 40th Armoured Brigade. Here, Jordanian tank crewmen stand in front of their Al Hussain tanks during a military ceremony in Qatraneh on 4 April 2016. (Getty Images)

was based on the prospect that both countries would need to replace their current designs at about the same time. Development centred on a new technology tank gun using either solid or liquid propellant, and even more advanced technologies such as an electro-magnetic rail gun were being examined. However, it became evident that a liquid-propellant gun could not be fitted to a tank by 2000.

Even before it entered service, the limitations of Challenger's fire-control system and the need to modernize its turret systems had been recognized. Accordingly, a series of extensive modifications was under way, known as CHIP or the Chieftain/Challenger Improvement Programme. The development of a new high-pressure 120mm rifled gun, the XL-30, and high-performance ammunition, including depleted uranium (DU) penetrators, was also progressing under the designation CHARM or Chieftain/Challenger Armament. Originally both programmes were to be implemented on Chieftain and Challenger, although it was realized that retaining Chieftain into the 1990s was increasingly risky in face of the improvements in Soviet tanks. For this reason, Chieftain separately underwent an up-armouring programme known as Stillbrew and was fitted with TOGS to give it a true night-fighting capability.

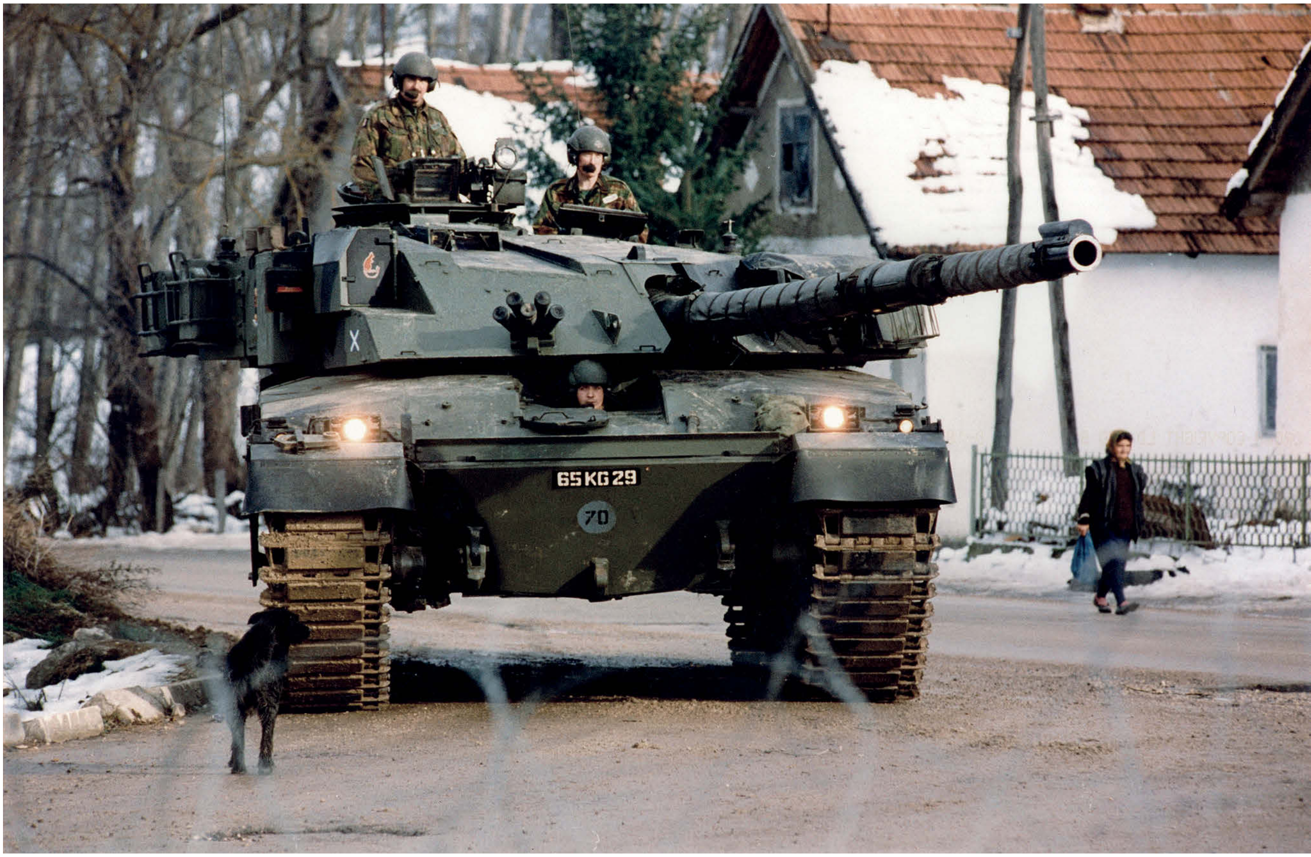
However, the plan for a CHIP/CHARM-improved Chieftain to soldier on through the 1990s depended on it being replaced by a new tank before 2000, but this was now highly unlikely. It was at this stage that Vickers Defence Systems, which had recently acquired the former ROF Leeds with its excess manufacturing capability, offered to build a replacement for Chieftain on the basis of a fixed-price contract. The design would essentially combine a

A CRARRV tows a Chieftain Mark 5/2K at speed during a demonstration of Challenger 2 and CRARRV to the Kuwaiti army in 1992. As one Kuwaiti armour officer ruefully stated at the time – "That's the fastest I have ever seen a Chieftain go".

Challenger hull and automotives with the turret of the Vickers Mark 7 private venture export model. The new model was somewhat confusingly designated Challenger 2 Mark 2.

It was against this background that Challenger then entered CAT '87 and was seen to perform even worse than Chieftain. Not only was the Royal Armoured Corps shown in a poor light, but the competition also raised doubts about its operational efficiency and the efficacy of its equipment. In the immediate aftermath, several senior officers within the RAC tendered their resignations, but these were refused pending a detailed analysis of Challenger during CAT '87. A formal inquiry was convened at the RAC Gunnery Wing at Hohne on 9 July which examined every aspect of crew and tank performance. Its report found that there had been many reasons for the failures during CAT '87 including mistaken selection procedures for the competition team; the extensive training commitments for British armoured regiments, unlike the opposing teams who in most cases trained almost exclusively for CAT for seven months or more; the totally inadequate provision of training simulators and coaching aids; the size of troop with only three tanks proved to be disadvantageous psychologically; and the use of prototype equipment for the competition was deemed to be a mistake, both with the ICSS and the 15x magnification commander's sight which compromised observation of the fall of shot. However, most of these were peripheral and the report concluded that the fundamental cause of the persistently disappointing scores in CAT was the complexity, poor ergonomics and susceptibility to failure of the turret systems of Challenger and Chieftain, compounded by the use of three-piece ammunition, leading to human error. This placed British crews under far greater strain than others and imposed an intolerable training load that was exacerbated by the deplorable lack of simulators.

The outcome of the competition was known in the highest political circles and leading questions were being asked about British tank procurement procedures. The concerns in government led to various demonstrations of Challenger together with Abrams and Leopard 2 which proved irrefutably that it was seriously deficient when firing on the move against moving targets. With the prospect of any future main



A Challenger 1 Mark 3 of Command Troop, Nunshigum Squadron, The Royal Scots Dragoon Guards (Carabiniers and Greys), stands guard on a road in Central Bosnia in 1996 with the Desert Rats symbol of 7th Armoured Brigade on the TOGS door and the Saltire on the turret side below. The formidable presence of a Main Battle Tank in a rural society more used to the horse and cart was a distinct disincentive to the warring factions to disrupt the fragile peace.

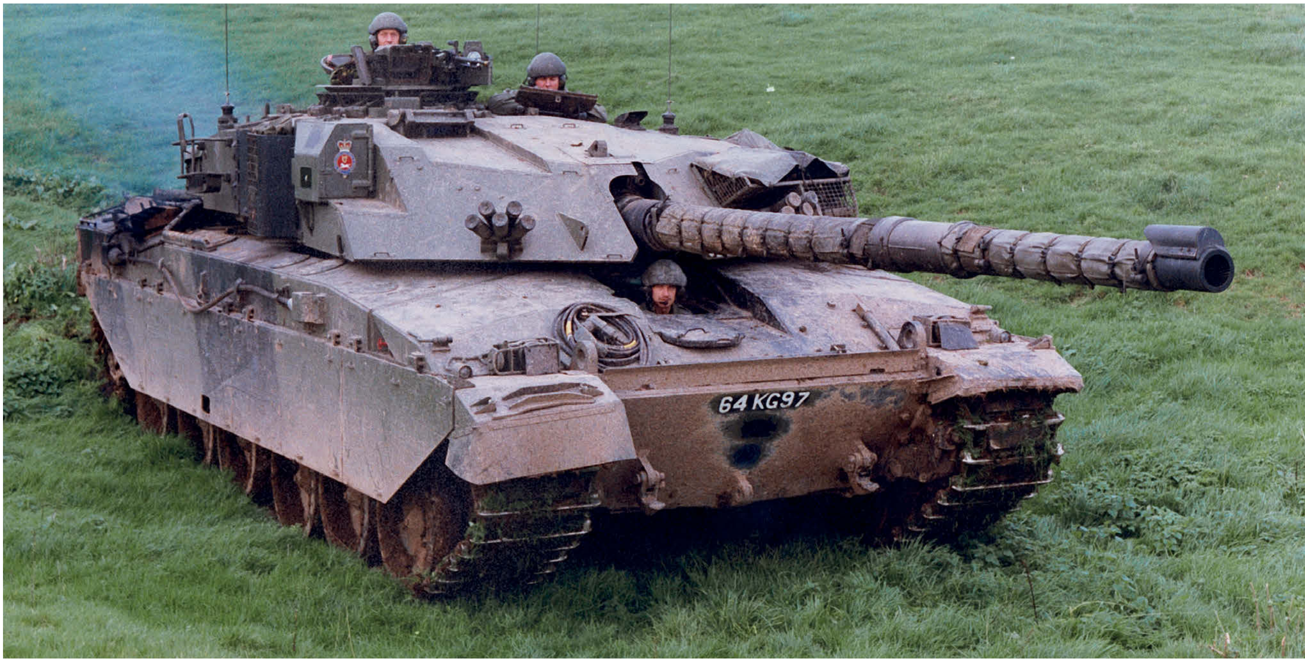
battle tank incorporating advanced technology receding well into the 21st century, it was decided that a replacement for Chieftain had to be pursued separately and as quickly as possible. Accordingly, a paper was prepared for the Equipment Policy Committee of the Ministry of Defence outlining the options available for a replacement for Chieftain. These included the current Challenger; Vickers Defence Systems' proposed Challenger 2 Mark 2 together with a Mid-Life Improvement Programme for the existing Challenger fleet; and two foreign options that were improved versions of the Abrams M1A1 and Leopard 2.

In November 1987, the Equipment Procurement Committee endorsed Staff Requirement (Land) 4026 for the Chieftain replacement programme. This began with a preliminary assessment of the formal proposal by Vickers Defence Systems for its Challenger 2 Mark 2, which for the sake of simplicity the Ministry of Defence called Challenger 2 while the existing MBT became Challenger 1, comparably with the Abrams M1A1 and Leopard 2 then in service with their respective armies. Neither of the latter as they existed at the time fully met the British requirements for a Chieftain replacement. However, in the wake of CAT '87, there was considerable dissatisfaction with Challenger, both in the upper reaches of government and within the Royal Armoured Corps. Since doubts had been expressed at the level of armour protection of Leopard 2, a strong faction within the army declared an interest to forego any further delays and procure the Abrams M1A1 which was seen to be a mature and proven design. To others, for the country that invented the tank, the concept of not buying a British tank was unthinkable.

ABOVE In January 1996, two armoured squadrons and a headquarters squadron of The Queen's Royal Hussars deployed to Bosnia as part of the British contingent of the NATO Implementation Force or IFOR. Here, DROITWICH heads a column of AFVs through an area of devastation at Mrkonjic Grad, in the first patrol conducted by the Challengers of the Queen's Royal Hussars.

LEFT With its name CAERPHILLY – this Challenger 1 Mark 3 of 3 Troop C Squadron, 1st The Queen's Dragoon Guards, displays its allegiance to 'The Welsh Cavalry' as it is refuelled from a Bedford TM Bowser during a patrol in the Bosanski Petrovac area of Bosnia in 1996.

In the event, extensive comparative trials ensued of four contenders for the Chieftain replacement programme: Challenger 2, Abrams M1A2, Leopard 2 (Improved), and the Leclerc. All proved to be highly capable, with each excelling in one aspect or another, and a final decision was to be made by the Equipment Procurement Committee in December 1990. But once again world events were to impinge on British tank procurement plans. Whereas Challenger was born out of the fall of the Shah of Iran, the collapse of the Warsaw Pact resulted in 'Options for Change' which, under Treasury demands to provide a 'peace dividend', dramatically reduced the number of MBTs to be procured. Initially the intention had been to replace Chieftain on a one-for-one basis and interoperability with the rest of NATO on a purchase of some 500 MBTs was a major factor, with standardization on the 120mm smoothbore gun being desirable. At this number, the economy of scale favoured the Abrams, while on the other hand, co-producing Leopard 2 would give



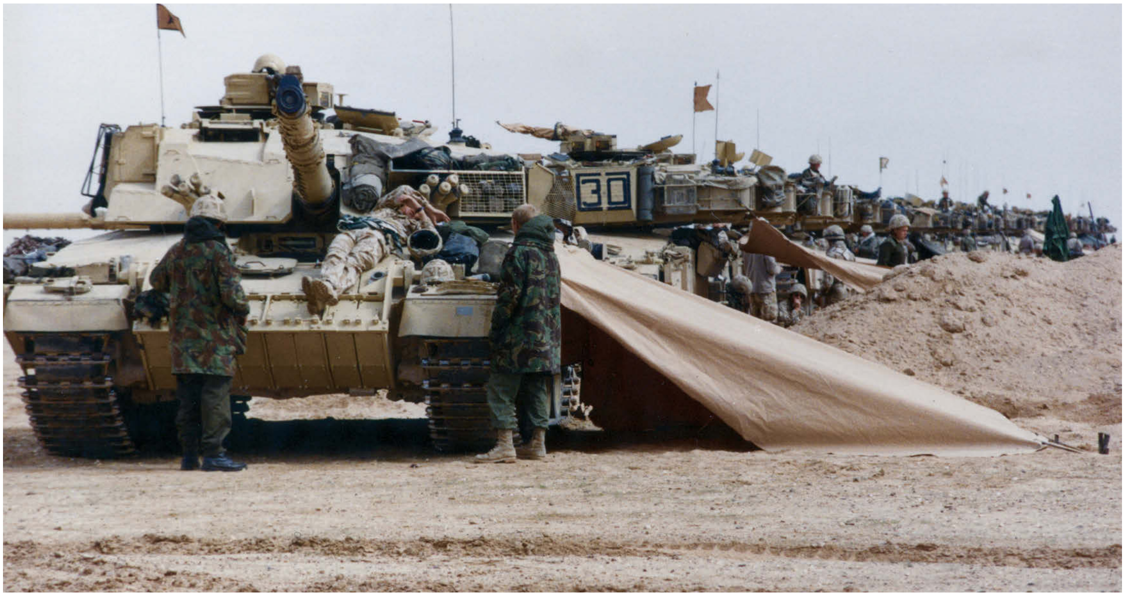
A Challenger 1 Mark 3 of 2 Troop D Squadron The Queen's Royal Hussars, pauses during Exercise First Crusade on Salisbury Plain in October 1995. The Mark 3 variant has a revised internal layout and armoured charge bins for greater protection of the two-piece ammunition propellant. As the final production model, 156 Challenger 1 Mark 3s were built with the last deliveries to the British Army being made in 1990.

Britain the chance for foreign sales to countries Germany was not allowed to export to. However, Iran's traditional enemy Iraq had become the focus of world attention following its successful invasion of Kuwait, and the deployment of 1st (UK) Armoured Division to the Gulf region deferred any decision until such time as the Gulf War allowed an assessment of the battle performance of Challenger and Abrams.

In the event Challenger went to war and was not found wanting. In no small part this was due to Vickers and other major contractors – such as Barr & Stroud, David Brown, Perkins, Marconi, Commercial Hydraulics et al – which provided the expertise and support that allowed an availability rate of over 90 per cent to be achieved throughout the campaign. It proved once again that British industry could produce the goods; it helped that financial restraints imposed by the Treasury were removed for the duration of the war.

In what has been termed 'the only tank battle to be fought on British soil', Vickers Defence Systems were finally awarded a contract at midnight on 28 June 1991 for 127 Challenger 2 MBTs and 13 Driver Training Tanks. This was the minimum number of tanks that was necessary to maintain a viable production line at a rate of approximately 35 tanks per year. With a total value of about £500 million, the contract included an integrated Logistic Support Package whereby VDS was responsible for all aspects of introducing Challenger 2 into service with the first two armoured regiments (Royal Scots Dragoon Guards and 2 RTR) to be equipped with the new MBT.

At the same time, approximately £275 million was budgeted for a Challenger 1 Mid-Life Improvement Programme which was also to be managed by VDS. Various measures were proposed, from rearming Challenger 1 with the L30 high-pressure gun to replacing the complete turret with that of Challenger 2. However, in the further round of defence cuts known as 'Front Line First', the Ministry of Defence abandoned the plan to upgrade the Challenger 1 fleet and instead ordered an additional 259 Challenger 2 MBTs from VDS. Furthermore, the Royal Armoured



ABOVE The crews of D Squadron Royal Scots Dragoon Guards relax during the final days prior to the land offensive in February 1991. Note the rectangular pennants on the antennae indicating D Squadron while the larger one in the centre with the triangular cut out is a Knight's Pennant denoting a troop leader.

LEFT On arrival in Kuwait, the Challenger tanks and Warrior Infantry Fighting Vehicles began extensive combined arms exercises to master the exacting desert conditions where self-sufficiency is vital but with stowage space always at a premium. In time, each unit devised its own SOP for vehicle stowage and internal layout for enhanced commonality.

Corps was reduced from 13 tank regiments to eight with two in Britain and six in Germany. In turn, each tank regiment was reduced to 38 MBTs compared to 50 in the previous organization, with two at regimental headquarters and three squadrons each with four troops of three tanks. The new composition of the Type 38 organization was designed to preserve more of the army's famous cavalry regiments rather than being for any particular tactical considerations. Thus, by the turn of the century, the British Army is scheduled to have a total of 386 Challenger 2 MBTs with 304 in frontline service and the remainder being used for training and war reserves. The Challenger 1 fleet will be disposed of although a number of hulls may be retained and converted to combat engineer vehicles capable of the same degree of mobility as the Challenger 2 MBTs they are required to support.

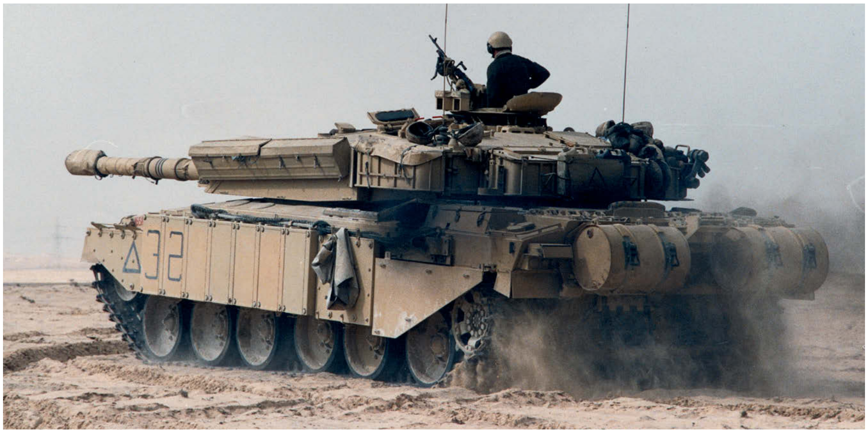
THE GULF WAR: OPERATION DESERT SABRE

In 1990, following the final deliveries of Challenger, the British Army had a total of 1,202 gun tanks in service, comprising 752 Chieftains, 420 Challengers, and 30 Centurions AVRE with the Royal Engineers. At this time the Royal Armoured Corps comprised 17 armoured regiments with the seven equipped with Challenger being stationed in Germany with the 1st, 3rd and 4th Armoured Divisions of 1st British Corps, as one of the four corps of the Northern Army Group within NATO. There were two forms of tank regiments; the Type 57 in armoured brigades and the Type 43 in mechanized brigades. A Type 57 armoured regiment comprised four squadrons, each of four troops of three tanks with two tanks in squadron headquarters and one in regimental headquarters. A Type 43 armoured regiment was similarly organized but with only three squadrons.

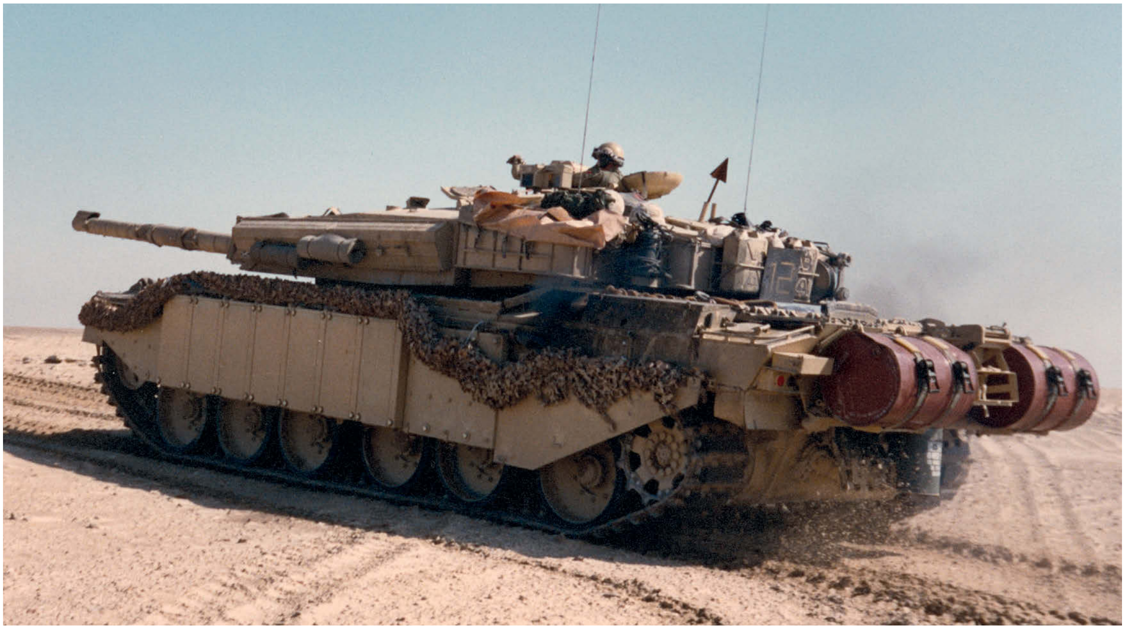
Following the Iraqi invasion of Kuwait on 2 August 1990, the British government supported the United Nations coalition forces tasked with responding to such blatant aggression by deploying 7th Armoured Brigade from Germany to Saudi Arabia. Retaining the title of 'The Desert Rats', the brigade comprised two armoured regiments equipped with Challenger, the Royal Scots Dragoon Guards (Carabiniers and Greys) and the Queen's Royal Irish Hussars (QRIH), and an armoured infantry battalion, 1st Battalion the Staffordshire Regiment (1 Staffords) equipped with Warrior IFV. There ensued a hectic period of preparation at Fallingbostel to bring the various units up to wartime establishment. By the end of October, 7th Armoured Brigade Group had arrived at Al Jubayl on the eastern coast of Saudi Arabia where the brigade came under the operational command of the 1st (US) Marine Division of the 1st Marine Expeditionary Force.

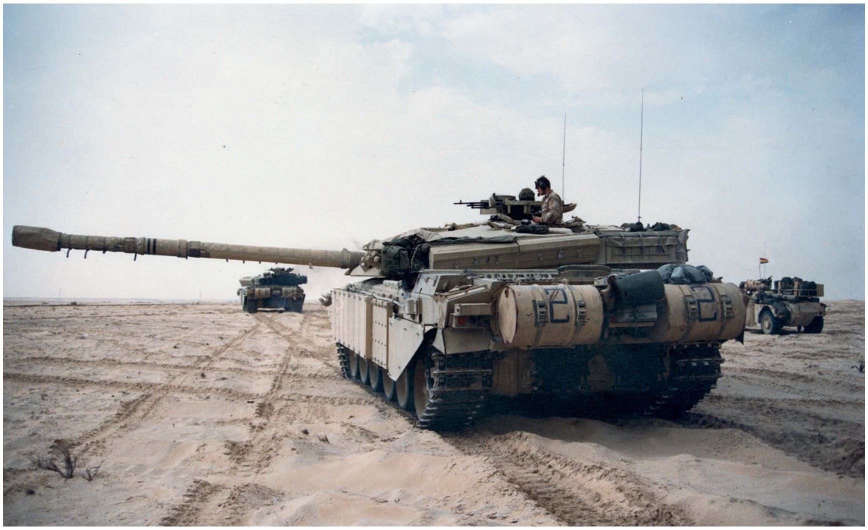
From the outset the decision was taken to equip the tank regiments with the Mark 3 variant of Challenger with its armoured charge bins, for the greater protection they provided to the crews, while the Mark 2s were cannibalized for spare parts. As the

RIGHT The countdown to G-Day continues on the Kuwaiti border with tank crews now bedecked in NBC protection suits, combat body armour, anti-flash hood and gloves as well as anti-laser goggles. All were soon discarded once combat began since they made operating the tank nigh on impossible.



BELOW RIGHT A Challenger Mark 3 of Three Troop A Squadron 14th/20th King's Hussars takes part in one of the final exercises prior to the land war. The Mark 3 featured armoured charge bins for the propellant charges giving increased survivability whereas the Mark 2 did not. Accordingly when the Challenger Mark 2 was deployed with Operation Granby 1.5 these too were fitted with armoured charge bins to become Challenger Mark 2 ACB.



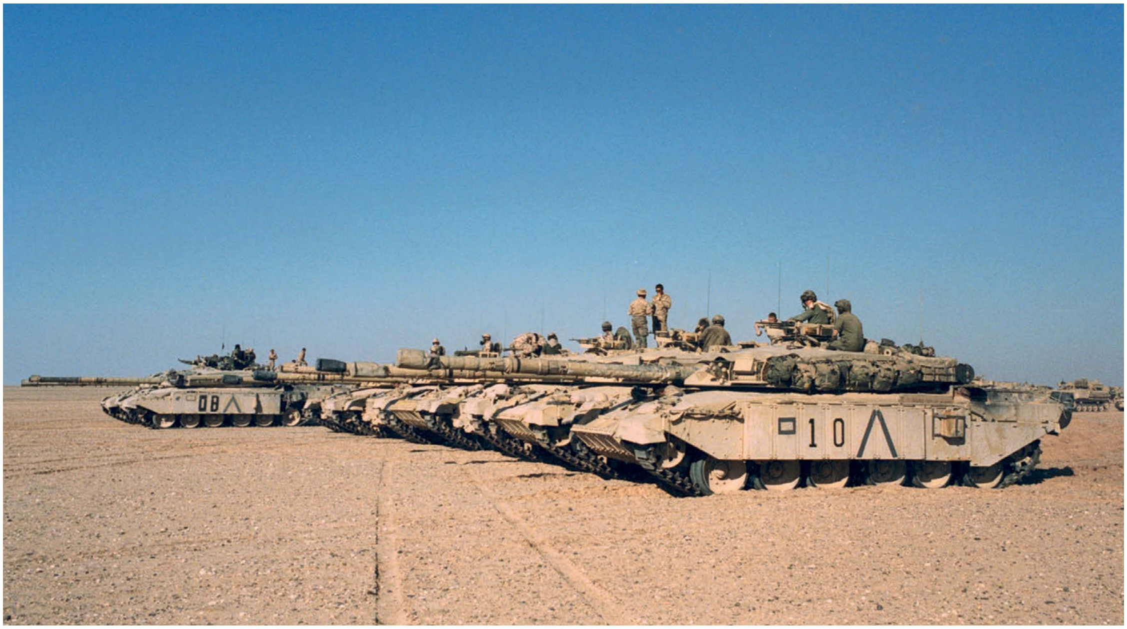


ABOVE From the outset of Operation Granby, the Military Vehicles Experimental Establishment and Vickers Defence Systems, as well as the major Challenger sub-contractors, devised a series of enhancements to improve survivability, firepower and mobility. This Challenger of 1 Troop A Squadron Royal Scots Dragoon Guards, shows the auxiliary 45-gallon fuel drums attached to the rear hull that extended the operation range by 150km on approach marches.

LEFT Among the most important modifications was the addition of Chobham armour panels, as developed for Warrior IFV, along the sides of Challenger and Explosive Reactive Armour blocks on the glacis plate and lower front hull. Such supplementary armour gave the crews great confidence in their 'Challies' as was proven in battle when none were damaged or knocked out by enemy fire.

tanks arrived in the port of Al Jubayl, they underwent a series of 'Quayside Modifications' to enhance reliability in the desert conditions. These were carried out by REME personnel and an Engineering Support Team composed of engineers from the principal contractors responsible for Challenger, including Vickers, Perkins, David Brown, Barr & Stroud and Marconi. Subsequently, the team supported the armoured regiments in the desert by instructing crews in the prescribed procedures for vehicle operation and maintenance. Through their unstinting efforts and the dedication of the tank crews, 174 out of the 176 Challenger MBTs committed to battle crossed the start line at the outset of the land offensive – Operation Desert Sabre; the other two tanks collided and damaged their guns.

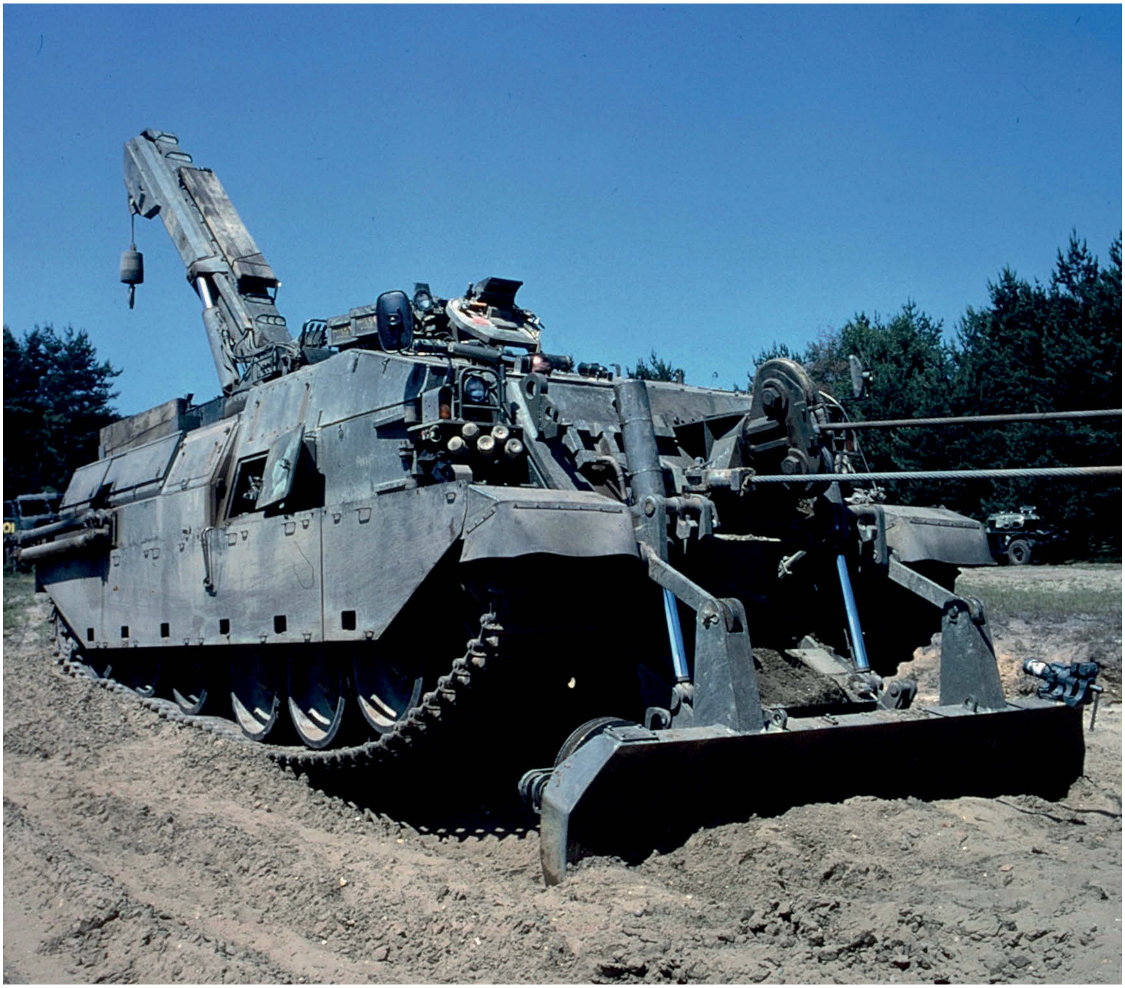
Once these modifications were complete, the tanks deployed to the desert and training began in earnest in the area of Al Fadhili, with gunnery being performed on



During the Gulf War of 1991, the armoured regiments of 1st (UK) Armoured Division were reinforced by men and units from across the Royal Armoured Corps. The 14th/20th King's Hussars were part of 4th Brigade with an attached squadron of The Life Guards as its C Squadron. During Operation Granby, the 14th/20th provided armour support to 1st Battalion Royal Scots and 3rd Battalion Royal Regiment of Fusiliers. Here, 1 Troop of D Squadron and Zero Bravo of the squadron leader make their final preparations just before the outset of the land offensive into Kuwait.

the Jerboa Range. On 16 November, 7th Armoured Brigade Group was declared operational with the task to prepare for counter-penetration operations in support of 1st Marine Division. In some minds within the US high command, there remained lingering doubts about the efficacy of British equipment, particularly Challenger after CAT '87, but these were dispelled after a series of dramatic live-firing exercises on the Devil Dog Dragoon Ranges – a combined US Marine and British training area. As planning began for offensive operations to liberate Kuwait, it was realized that 7th Armoured Brigade Group was likely to be in action in support of the US Marines against heavily fortified defensive positions culminating in fighting in the streets of Kuwait City. Accordingly, the tanks would be facing a gamut of anti-armour weapons at short ranges so it was decided to increase the armour of the Challengers along the hull sides, to protect those areas where the ammunition propellant was stowed in and over the hull front to give the driver greater protection. Other modifications included extra fuel drums and a smoke generating system that injected diesel fuel directly into the engine exhaust; both of these devices had been used on Soviet tank designs for many years.

Although each tank regiment was supported by Chieftain armoured recovery vehicles, the Challenger Armoured Repair and Recovery Vehicle (CRARRV) was rushed into front-line service some seven months before it was due to join the British Army. The first four production models (Faith, Hope, Charity and Big Geordie!) were despatched on 24 September directly from the Vickers factory in Leeds to 7th Armoured Brigade Group in Saudi Arabia. In all, 12 CRARRVs were deployed in support of 1st (UK) Armoured Division. Divided between 4th and 7th Armoured Brigades, they served with the Forward Repair Groups rather than at regimental level. Overall, they covered some 19,000km (11,800 miles), 7,000km of which was while towing other AFVs. During the campaign the CRARRVs required five pack changes, giving a mean distance between failures of almost 4,000km (2,485 miles) which, incidentally, was the original General Staff Requirement for Challenger. The CRARRVs proved to be highly effective and achieved a 100 per cent availability rate during the land offensive. Over

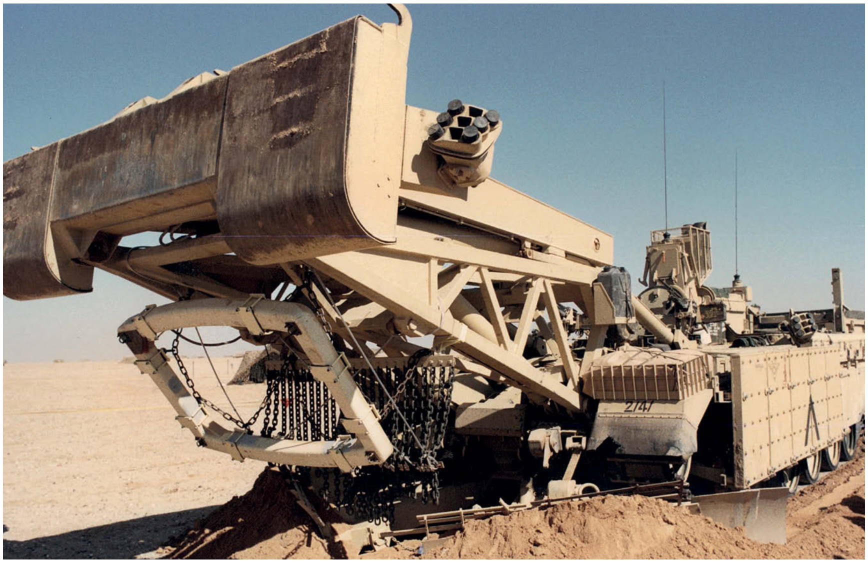


The production of the first 30 Challenger Armoured Repair and Recovery Vehicles or CRARRV began in 1989, but it entered service with the British Army prematurely because of the Gulf War of 1991: 12 were dispatched to Kuwait in time for the land offensive to start. With its Atlas AK6000 deployed to the rear, a CRARRV undertakes a heavy recovery task with its front dozer blade dug-in as an earth anchor. In all, the British Army procured 81 CRARRVs.

300 enemy AFVs were destroyed by Challenger MBTs but not a single one of the latter was lost in action during Operation Desert Sabre.

On 22 November, the decision was taken to increase the strength of British ground forces with the addition of 4th Armoured Brigade and other support elements to form 1st (UK) Armoured Division, which was transferred from the operational control of the Marines to the US Army VII Corps to participate in the major offensive against the Iraqi Army. With two armoured infantry battalions, 1st Battalion The Royal Scots and 3rd Battalion The Royal Regiment of Fusiliers, and a single armoured regiment, 4th Armoured Brigade was in fact a mechanized brigade. For this reason, the armoured regiment, 14th/20th King's Hussars, was Type 43, and to bring it up to a wartime establishment of 57 Challengers it was reinforced by A Squadron The Life Guards as a complete sub-unit. As many of the regiment's tanks were Mark 2s, new armoured charge bins were designed and fitted in theatre, raising them to Mark 2 (ACB) standard; arguably this variant was better protected than the Mark 3 since its armoured bins contained the propellant charges in twos or 'doublets' rather than in the 'triplets' of the Mark 3.

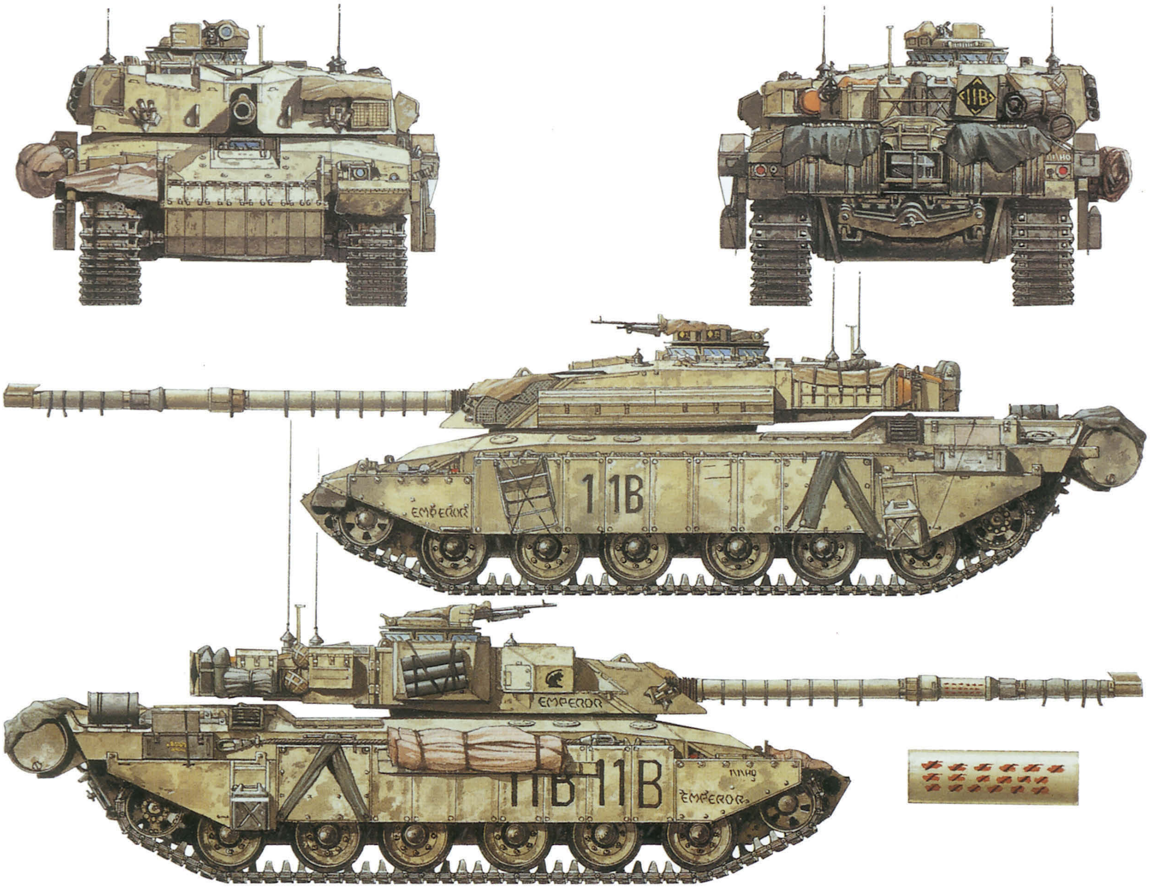
While these protective measures did much to boost the morale of the crews and instil confidence in the survivability of their tanks, enhancements were made to the



Virtually every Chieftain AVRE and CHAVLB was deployed during Operation Granby in the expectation that they would be required to breach the extensive Iraqi defensive fortifications along the borders of Kuwait. To this end, they were modified with supplementary armour protecting the crew compartment, comprising Chobham armour panels similar to those fitted to the Warrior IFV. By then both types of armoured engineering vehicles incorporated mineploughs, as shown here undergoing tests on a CHAVLB with its side-mounted Chobham armour panels, and a MIMIC – Magnetic Influence Mine Induction Coil – below the launching mechanism. This device was intended to detonate magnetic mines ahead of the vehicle. The CHAVLB also towed either an AVRE trailer carrying engineer stores or a Giant Viper trailer with its rocket-propelled explosive hose to clear a path through enemy minefields. Behind the MIMIC is a chain screen protecting the driver's compartment. This was intended to detonate anti-tank projectiles such as RPGs before they struck the AVLB's hull. These Chieftain variants were also used during Operation Telic in Iraq in March–April 2003.

offensive capabilities of Challenger with the introduction of a highly potent armour-piercing round. Under the codename Jericho, the L26A1 APFSDS round with its depleted-uranium penetrator was manufactured by Royal Ordnance as a counter to the T-72M that equipped the Iraqi Republican Guard. With its low silhouette, high speed, and powerful 125mm D-81 TM (2A46) main armament, the T-72M was deemed to be the only serious threat to Challenger on the battlefield. The new round was coupled with an improved propellant charge, the L14A1, which gave both better performance and greater safety. Each Challenger was issued with approximately 12 L26A1 rounds to be used exclusively against T-72Ms. In the event, no T-72Ms were encountered by 1st (UK) Armoured Division during the war.

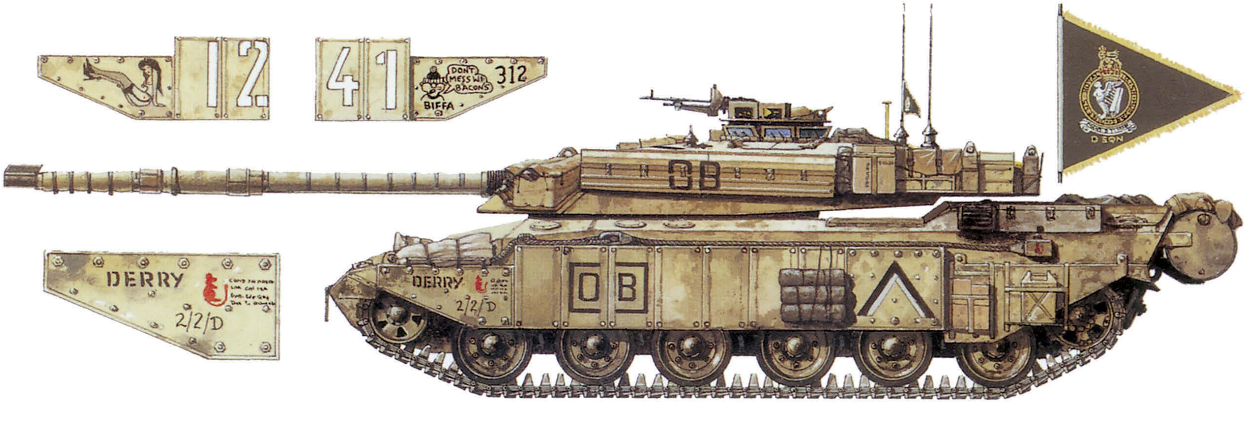
However, the two aspects of Challenger that proved to be fundamental to success on the battlefield were TOGS and GPS. The superiority of Challenger's Thermal Observation and Gunnery System over the sights and night-fighting capabilities of the Soviet tanks that equipped the Iraqi Army was fully appreciated before the war and determined the tactics for tank-vs-tank engagements. In essence, TOGS allows target acquisition and engagements in open terrain out to 3,000m – well beyond the capability of the Iraqis. Accordingly, all engagements were to be at long ranges and, if the enemy closed to within 1,500m, the Challengers were to fall back to maintain their long-range advantage. In the event, the weather was so foul during the conflict and the enemy's tanks were so predominantly static that these tactics were not applicable, although one SCOTS DG Challenger had a successful engagement against an Iraqi tank at 4,100m. The second battle winner was the GPS (Global Positioning System) navigation aid which for the first time in warfare allowed units to determine their exact position with a high degree of confidence, particularly in the featureless desert terrain of southern Iraq. Two types of GPS, Magellan and Trimble, were issued to British units on a typical scale of five per tank squadron. The system was highly efficient as long as sufficient satellites were in alignment for interrogation and it allowed coalition forces to manoeuvre freely around known enemy fixed positions and attack from the least expected quarter. At the same time, knowledge of the whereabouts of neighbouring friendly units was a major factor in reducing the incidence of fratricide or 'blue-on-blue'.



CHALLENGER I MK. 2 COMMAND TANK, REGIMENTAL HEADQUARTERS, 14TH/20TH KING'S HUSSARS, 4TH ARMOURED BRIGADE, 1ST (UK) ARMOURED DIVISION, KUWAIT, 28 FEBRUARY 1991 (LIEUTENANT-COLONEL MIKE VICKERY)

'EMPEROR' is the traditional name given to the commanding officer's tank of the 14th/20th King's Hussars. It derives from the Battle of Vittoria in 1813 during the Peninsular War when the 14th Regiment of (Light) Dragoons captured the coach of King Joseph Buonaparte as he fled the battlefield. Among the spoils was an item described as 'a silver utensil' which was in fact His Majesty's solid silver chamberpot. This gave rise to the regiment's nickname thereafter of 'The Emperor's Chambermaids', although the contemporary sobriquet is 'The Hawks'. The chamberpot has been preserved ever since in the Officers' Mess and does duty on special occasions as a 'loving cup' with the consumption of copious quantities of champagne. Bearing the registration number 36KA34, EMPEROR was one of only a few Mark 2 Challengers in the Gulf theatre that were not fitted with armoured charge bins before the war began. As the armoured regiment within 4th Armoured Brigade it carries the black jerboa brigade insignia on the TOGS barbette. On all quarters it displays the inverted black V mutual recognition device of the coalition forces and, on the sides and turret rear, the callsign One One Bravo, denoting the commanding officer. Accordingly, the EMPEROR is a command tank with a three-radio fit, including BID for secure clear speech communications with higher headquarters which proved to be of a significant factor in the successful conduct of the fast-moving land offensive. Draped over the top of the turret rear is a fluorescent orange air recognition panel and forward of that is the transponder stalk of the Trimble GPS navigation aid which was such a vital asset in the featureless desert; note the top of the device is painted white. On each forward Chobham armour side panel is the unit code 1/1/HQ - the first figure denotes 4th Armoured Brigade; the second the 14th/20th King's Hussars as the senior regiment within the brigade and finally the sub-unit within that regiment.

Painted in red on the fume extractor of the main armament are silhouettes of the enemy vehicles destroyed by the EMPEROR during the 100-Hours War; EMPEROR's contribution to the regimental 'gamebook' being five T-55s and eight other vehicles including a BRDM-2 which was about to engage the Hawks with Sagger missiles before it was destroyed by One One Bravo.



CHALLENGER I MK. 3 CONTROL TANK, D SQUADRON, QUEEN'S ROYAL IRISH HUSSARS BATTLE GROUP, 7TH ARMOURED BRIGADE, 1ST (UK) ARMOURED DIVISION, SOUTHERN IRAQ, 25 FEBRUARY 1991 (MAJOR TOBY MADDISON)

DERRY was the first British tank to move out of the bridgehead created in the Iraqi frontlines by the 1st (US) Infantry Division (Mechanized) – 'The Big Red One', crossing Phase Line New Jersey to lead the breakout of 7th Armoured Brigade at 1515hrs on 25 February 1991. The obligatory yellow air recognition panel is lashed down over the turret basket with the rectangular shaped TOGS indicator and Trimble GPS transponder stalk showing vertically from the turret roof. The callsign is repeated on the rear fuel drums with zero on the left and B on the right hand one, applied freehand in black paint.

The scrap views show two examples of what was known as 'bin art' which became more prevalent as the date of the land offensive approached – a popular theme being characters from VIZ magazine, such as Biffa Bacon, whereas the classic pin-up is a direct response to the 'nose art' applied to Royal Air Force and USAF aircraft in the Gulf War. These two designs appeared on tanks of The Royal Scots Dragoon Guards. The vehicle registration number is 64KG97, visible only on the rear hull plate beside the right-hand light cluster.

All the tanks within QRIH were named after towns and villages in Ireland beginning with the squadron letter; the subject vehicle being DERRY which caused a certain amount of contention among the interdenominational crew. The name is applied on each forward Chobham armour side plate with the crew zap code and the unit code 2/2/D below applied freehand in black paint. The unit code is also painted on the left front mud flap as viewed. Between the vehicle name and the zap code is the red jerboa of the Desert Rats. This also appears on the faces of the rear attachment points for the towing cables on the hull sides and above the right-hand rear light cluster.

With a richly embroidered pennant bearing the regimental insignia flying above the turret, Zero Bravo is the mount of the officer commanding D Squadron which was at the forefront of the QRIH Battle Group throughout much of the offensive; the squadron tally in the war being 22 T-55/59; one BMP-1; three MTLB; seven artillery pieces and six trucks. On the forward turret roof is the black chevron mutual recognition device which is repeated on the hull sides and on the rear of the turret basket; the latter being painted on the folded-out cardboard packaging of a 24-hour combat rations box. This and the two black side chevrons have metallic silver tape inserts which were intended to aid recognition through TOGS but they had no appreciable effect. Taped to the turret roof just in front of the commander's primary sight are detector papers which change colour when exposed to particular chemical or biological agents. A further black chevron is painted on the commander's hatch pointing forwards. Welded centrally to the nose of the tank is a metal bracket which acted as a step for the commander who had sustained a serious knee injury playing hockey; a device copied by several crews in the squadron. For his gallantry during the war, Major Toby Maddison, commanding D Squadron, was awarded the Military Cross.

The use of GPS in combination with TOGS gave the battlegroups of 1st (UK) Armoured Division a significant advantage over the enemy as Challengers led repeated day and night attacks with the armoured infantry in their Warriors against a succession of Iraqi brigade-sized positions; each objective being codenamed by a particular metal, e.g. Copper, Bronze, Zinc, and Steel. Within 100 hours the Iraqi Army had been routed by the coalition forces. However, to the trooper in a Challenger tank or the rifleman in the back of a Warrior, having endured weeks of discomfort in the desert and suffered multiple injections against the appalling threat of chemical and biological agents, in the certain knowledge that he was facing one of the largest

During the late 20th century, environmental considerations reduced the viability of tank training grounds in Germany so a new exercise area was found in Poland following the collapse of the Soviet Union. Under the codename Exercise Ulan Eagle, British Army battle groups undertake high-intensity armoured warfare manoeuvres embracing all arms but without the live-firing facility of BATUS. Here, Challenger MBTs of Cyclops Squadron of 2nd Royal Tank Regiment negotiate the Drawsko Pomorskie Training Area during Exercise Ulan Eagle in 1996.

armies in the world which had had many months to prepare defensive positions, all these factors remained an unknown quantity as they crossed the border into Iraq. It is a tribute to the professionalism of the soldiers of the British Army that to a man they faced this prospect without demur and prevailed, while retaining an essential humanity towards the enemy soldiers they fought. Part of this professionalism was an unstated confidence in their equipment, be it Challenger or Warrior, both of which are demanding vehicles to operate but once mastered they have few equals. In the words of Brigadier Patrick Cordingley DSO, Commander 7th Armoured Brigade, 'I have always said that Challenger is a tank built for war and not competitions'.

QRIH BATTLE GROUP

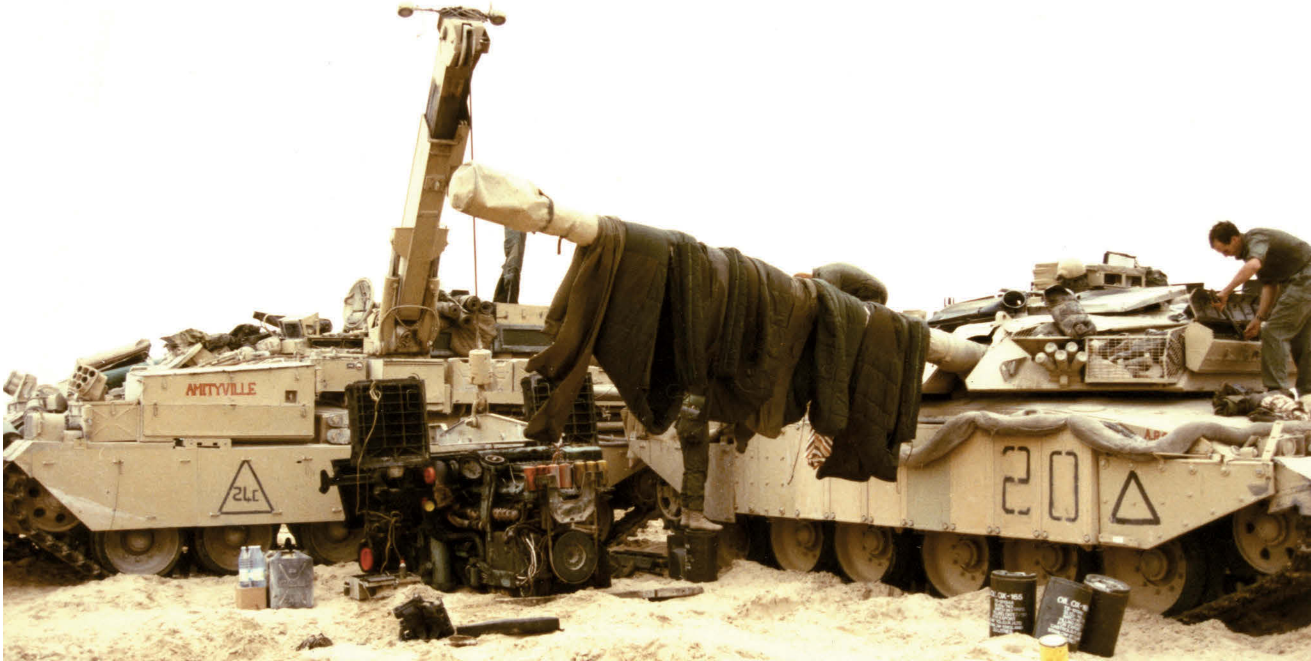
Each of 7th Armoured Brigade's major units was formed into independent battlegroups of tanks and armoured infantry together with supporting arms. Following months of training in the desert, close cooperation between armour and infantry was honed to a high degree allowing maximum flexibility in combat. Space precludes a complete account of 1st (UK) Armoured Division during Operation Desert Sabre, so the exploits of a single battlegroup are recorded through the words of the Challenger crews themselves. As was commonplace during the Gulf War, each armoured regiment was reinforced by personnel from across the Royal Armoured Corps. Within the Queen's Royal Irish Hussars, the fourth troop in each of the four squadrons comprised crews from the Queen's Royal Lancers since they were among the most experienced users of Challenger at the time. As part of the US VII Corps, 1st (UK) Armoured Division formed the right-hand flanking force in the major offensive to engage and destroy the Iraqi Republican Guard equipped with the potent T-72. On G-Day, 24 February 1991, the US 1st Infantry Division breached the sand berms and minefields constructed along the Iraqi–Saudi border.

The Battle Captain of B Squadron QRIH, Captain Jonny Ormerod, recalled the dramatic events of the opening day of the land offensive:

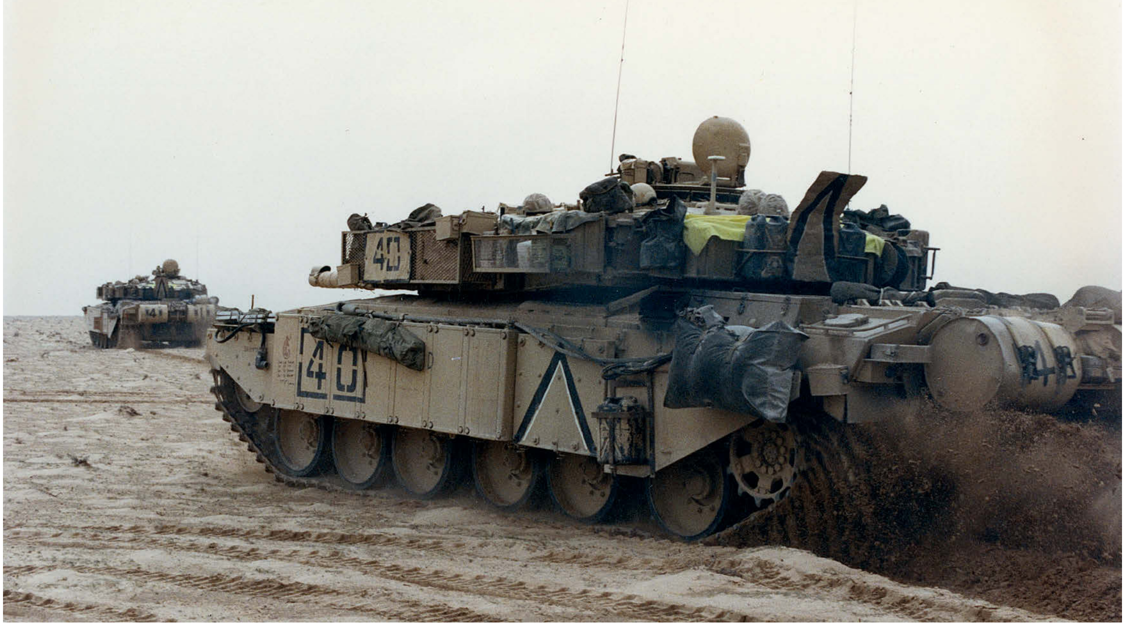
> At 0200hrs the 1st Infantry Division, 'The Big Red One' of the US VII Corps, crossed the Iraqi border, seizing a bridgehead as far as Phase Line New Jersey by 2359hrs that day. Shortly after 1400hrs the Squadron moved off to the Regimental Staging Area… We had practised this procedure on numerous occasions and for many it was difficult to imagine it was the 'Real Thing'! The transporters failed to materialize, presumably because everything was brought forward so quickly and after a series of rapid briefings we moved up to the Forward Staging Area on tracks, arriving there about 1700hrs… At this stage we were unsure as to when we were going to move and were relieved to eventually hear that we would get a full night's sleep…Zero Charlie [Captain Ormerod's Challenger BALLYJAMESDUFF – all the QRIH tanks were named after Irish towns and villages] was worked on all night by Sergeant Clarke and his crew.

On Monday 25 February, G+1, Battle Group Orders were given in the Forward Staging Area at 0745hrs and the advance to FUP [Forming Up Place] began at 1005hrs. At 1215hrs B Squadron QRIH crossed into Iraq on Phase Line Vermont as the spearhead of 1st (UK) Armoured Division. Speculative fire on suspected enemy positions was initiated at 1615hrs as the tanks advanced rapidly to Fire Line Burt: so named after the dog Burt belonging to the commanding officer of the QRIH, Lieutenant Colonel Arthur Denaro. There the Regiment was ordered to provide direct fire support for 1 STAFFORDS/SCOTS DG attacking north-south through Objective Copper North that was cleared by 2200hrs. Captain Tim Purbrick of the 17th/21st Queen's Royal Lancers commanding 4 Troop D Squadron QRIH described the advance into Iraq:

> At around 1030hrs on the 25th February G+1, D Squadron QRIH led the 44 tanks of the Battle Group out of Staging Area 3 and we drove 40 kilometres into Iraq and the bridgehead made by the 1st (US) Infantry Division. In FUP Blue we shook out in preparation for taking up the advance. The SQMS fuel truck gave most tanks a squirt



In order to maintain the maximum availability of Challenger 1 during Operation Granby virtually every CV12 powerpack in BAOR and the UK was despatched to the Gulf with many powerpacks being changed in the field as here with a Chieftain ARRV Mark 7 supporting a Challenger 1 of A Squadron 14th/20th King's Hussars prior to the land campaign.



The Challenger Mark 3 of Captain Tim Purbrick, troop leader of 4 Troop, D Squadron, Queen's Royal Irish Hussars, advances into Kuwait under the leaden skies that characterised the land war in February 1991. As a troop leader, this Challenger is equipped with Trimble GPS visible on the stalk behind the commander's hatch. The Global Positioning System was fundamental to the victory of the Coalition forces, allowing them to outmanoeuvre the enemy at every turn by day or night.

of diesel. Two kilometres later we took up the advance from the Americans not only for the Irish Hussars, but also for the 7th Armoured Brigade, the 1st (BR) Division, and VII US Corps. The ground was rolling desert with scrubby bushes and overcast skies, but no enemy so far. As night came on, rain rolled in and our thermal pictures degraded such that we could just about make out the tank in front and it was only due to satellite navigation systems that we could maintain any kind of movement.

Despite the foul weather the advance continued and at midnight on G+1, the QRIH and STAFFORDS battlegroups were poised to attack Objective Zinc: an Iraqi brigade-sized position. At 0100hrs, the guns of 2 and 40 Field Regiments, Royal Artillery, opened fire on nine designated targets on Objective Zinc. In a barrage lasting 19 minutes, 48 guns each fired 30 rounds for a grand total of 1,440 shells, both 155mm and 8in as well as MLRS [Multiple-Launch Rocket System]. At 0150hrs, 1 STAFFORDS, QRIH, and SCOTS DG battlegroups moved onto Objective Zinc with the QRIH battlegroup in the centre. Earlier, SCOTS DG had been involved in a firefight in which half a dozen tanks and other vehicles were destroyed. The squadrons of QRIH moved all together, looking for hot spots with TOGS. Once a target was found, tanks used fire-and-manoeuvre. The weather overnight was appalling with cold drenching rain. From 0500–0600hrs, the Squadron tried to track a column of enemy vehicles using TOGS, seen at extreme range. 4th Troop Leader (Lt Tim Buxton 17/21L) reported that he had run over a scatterable mine. It turned out to be a MLRS bomblet which caused no harm to his Challenger. Later Major David Swann's tank BELFAST ran over another MLRS bomblet, which punctured the external fuel drums on the back of the tank, releasing all the extra fuel. By 0530hrs, Objective Zinc was cleared with some 50 AFVs destroyed or captured. Iraqi resistance was minimal. At 0620hrs, B Squadron moved forward to examine an enemy position just short of Phase Line Lavender.

B Squadron moved onto Line Lavender. Two or three vehicles were destroyed by Challengers including a BRDM. At 0720hrs, three or four men were seen in trenches. At 0724hrs a B Squadron tank knocked out a T-55 with two rounds of HESH. Fifteen minutes later, five enemy vehicles were seen moving south. A number of tanks were

The Challengers of 2 Troop B Squadron Royal Scots Dragoon Guards pause during the advance into Iraq. Note the square squadron indicators above the rear turret roof that is readily visible through TOGS so allowing mutual recognition under even the most adverse visibility conditions.

> destroyed, including three T-55s, one of which was destroyed by Captain Jonny Ormerod and his gunner Trooper Cater 17/21L in OC. At 0752hrs, some 30 Iraqis surrendered and a number of tanks were engaged. At 0809hrs another group of 40 Iraqis surrendered to QRIH BG. My overriding impressions that night were twofold: firstly the professionalism shown in taking on the enemy, that is, the calmness in identifying and destroying those that threatened combined with the restraint and humanity shown to those who did not; secondly the devastating effect of artillery at night.

Captain Tim Purbrick of 4 Troop described the battle for Objective Zinc:

> By midnight we'd come 100km and up against the edge of an enemy position codenamed Zinc – it could have been the 12th Armoured Division of the Iraqi Army, but real-time intelligence couldn't help us with exactly what was in front of us. So at 0115hrs (26th February) a 19-minute artillery and MLRS strike began to soften up the enemy. When the barrage lifted we pushed forward gingerly about two kilometres, where we began to dig in for the night. Half an hour later numerous heat sources began to appear on our thermal pictures, moving from north to south across the rear of the enemy position before vanishing eastwards. D Squadron moved forward to engage this opportunity target, which was assessed to be tanks and trucks withdrawing. At the end of the short battle, ten or so enemy vehicles had been destroyed by a mixture of FIN anti-tank rounds and HESH explosive rounds. As dawn came up half an hour later, we began to see T-55 tanks, hull down, pointing towards us. Our initial engagement began with HESH, which we had loaded for our night battle. The first round fell short, showering the enemy tank with sand and shrapnel. We loaded FIN and this round went into the berm behind which the tank was hiding, whilst the third and final round entered the glacis plate and exited through the gearbox at the rear, igniting its bomb load and destroying the tanks at a range of 3,600m. A few minutes later we took on an unidentified vehicle at 4,700m – 2½ miles away – scoring a first-round hit, causing the vehicle to explode in a massive fireball. It continued to burn for the next hour. Our first 24 hours at war had seen us advance 100km into enemy

> territory, surprising the Iraqis – and ourselves – with our speed and ability to bring down fire accurately, to destroy enemy vehicles, whilst remaining invisible to him and beyond his maximum engagement ranges.

Lt Will Wyatt 4 Troop C Squadron 17/21 Lancers made the following observations on this phase of the battle:

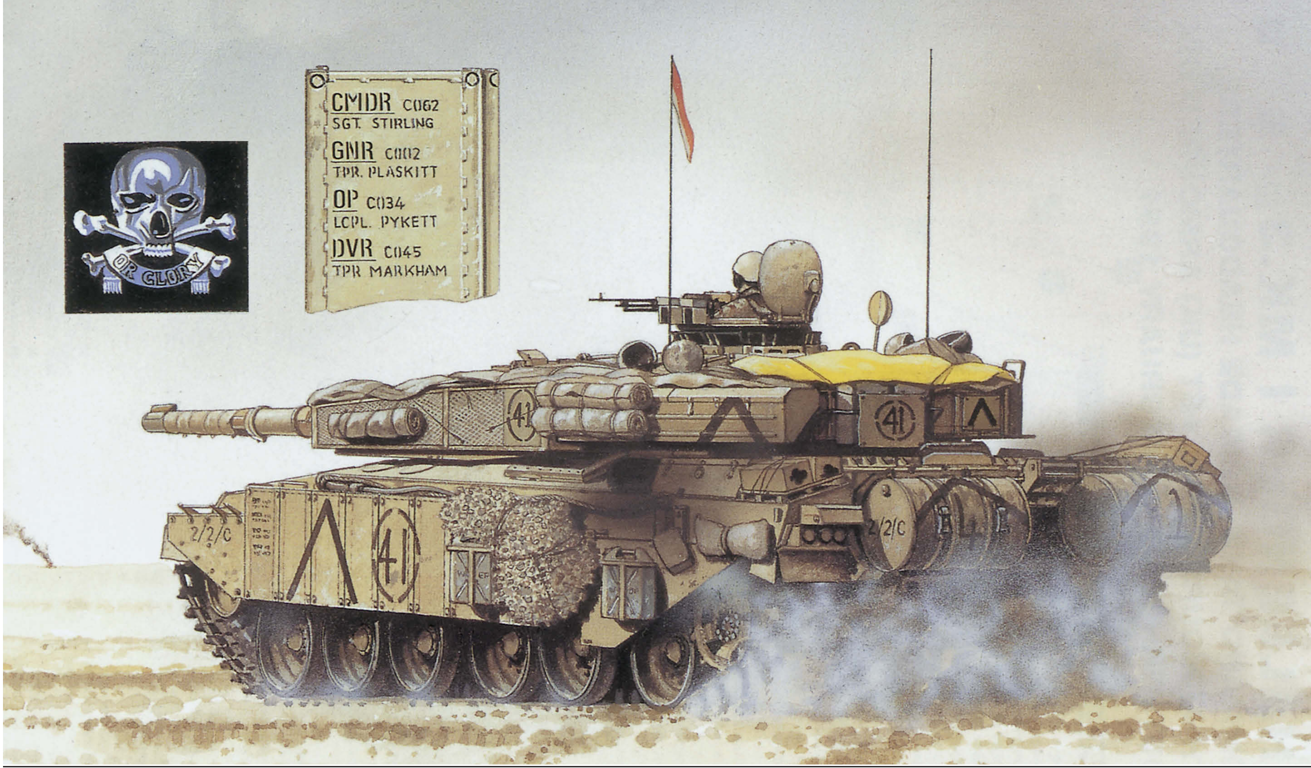
> We had little involvement in the actual night battle for Objective Zinc but took a staggering number of prisoners, which surprised us more than it did them, as we didn't have to fire a single shot. It proved a good way to break ourselves into the oddities of war and was certainly a better first contact than it could otherwise have been! We also had an amazing view of the battle slightly further south, certainly the best fireworks display any of us will ever see! The night skies were lit by a continuous pounding of the MLRS and the flashes of tanks engaging.

Lt Tim Buxton 17/21 Lancers attached to B Squadron QRIH recalled the advance to Objective Platinum as follows:

> From Objective Zinc we advanced toward Objective Platinum 1. A regimental-sized enemy position with our own Lynx helicopters firing missiles over our heads combined with artillery. The sky was clear, but a vicious wind was whipping the sand up to about the level of the gunner's sight, making the visibility poor. We stopped approximately 2.5km short of the objective and engaged the enemy. 4th Troop saw most of the enemy, destroying four Iraqi tanks. The troop then pushed 600m further forward in front of the squadron to look for depth positions. We then went into Platinum 2. Little resistance was put up as the Iraqis had withdrawn some hours earlier. We then moved north halting just south of Line Smash. Here we resupplied with fuel and ammo and had a few hours' sleep. All the drivers got out of their cabs for the first time in two days.

Captain Jonny Ormerod recorded the actions of B Squadron, The Queen's Royal Irish Hussars, on G+3 as follows:

> It was at 0400hrs that the Squadron got the first hint of the task that lay ahead… Orders came. We were to advance into Kuwait to seize Objective Varsity. The Regiment was rear left in the Brigade and the Squadron was rear right in the Regiment. We were to move as soon as possible, we took up our normal leaguer formation and got moving very quickly… B Squadron were instructed by the Colonel to take over as point squadron. We crossed the Start Line on time, broke into advance formation, married up with the SCOTS DG and headed for the Kuwait border. To our front there were large groups of Iraqis and many more appearing out of the mist. The Squadron continued with Lt Buxton in front as the TRIMBLE tank… At about 0700hrs we led the Regiment into Kuwait across the Wadi al Batin… We approached an area of rough ground around a quarry, quickly named 'moon country'. Troops were split to the four winds as they searched for a route through. In retrospect, had this been a defensive position we could have suffered badly… We continued to Objective VARSITY which was unoccupied… For the first time we became aware of the burning oil-fields, the dark grey skies producing an eerie combination with the orange sand. For many crews it was the first opportunity to listen to the World Service and discover quite how devastating



CHALLENGER I MK. 3, C SQUADRON, QUEEN'S ROYAL IRISH HUSSARS, 1 STAFFORDS BATTLE GROUP, 7TH ARMOURED BRIGADE, 1ST (UK) ARMOURED DIVISION, KUWAIT, 28 FEBRUARY 1991 (SERGEANT TONY STIRLING)

When the Gulf crisis erupted on 2 August 1990, the QRIH had only recently joined 7th Armoured Brigade in Germany, having been stationed at Tidworth in UK equipped with Chieftain MBT. Accordingly, they were new to Challenger and were not scheduled to be fully operational until April 1991. Thus when 7th Armoured Brigade was deployed to the Gulf, the regiment was augmented by a complete squadron of 17th/21st Lancers who had served on Challenger for several years. To benefit from this experience, a formed troop of 17th/21st Lancers was attached to each squadron of the QRIH as their fourth troop. Four One within a circle denotes the Troop Sergeant's tank of 4 Troop, C Squadron. The latter, together with B Squadron, SCOTS DG, were detached from their parent regiments to form the tank element of 1 Staffords Battle Group. Originally named CRAIGAVON on the hull sides beside the driver's position, the name was not reapplied on the Chobham armour side plates. Instead the unit code 2/2/C is painted on the forward Chobham plate; the first 2 denoting 7th Armoured Brigade; the second 2 the QRIH as the second senior regiment within the brigade and C indicating C Squadron. This unit code is repeated on the sides of the rear fuel drums. On each of the second Chobham armour side plates is a zap code with the crew names and their respective functions, a practice peculiar to the QRIH. Behind that is the black chevron and vehicle callsign, both of which are also painted on the rear fuel drums as they are on the turret sides and rear. On the other side of the turret, the callsign Four One within a stencilled circle is painted on the Ferret stowage bin behind the TOGS barbette with the black chevron on the side of the TOGS compressor unit. Behind the commander's cupola is a TOGS indicator which being circular denotes C Squadron; A Squadron being triangular, B Squadron square and D Squadron rectangular, whereas in SCOTS DG the shapes applied to the troops within each squadron. With its registration number 64KG94, this Challenger 1 Mark 3 was commanded by a highly experienced gunnery instructor. Nine targets were engaged during the war of which eight were hit; the one miss being due to a wayward laser rangefinder. One T-55; three MTLBs and a trench system were destroyed. Unwilling to lose their identity as 'The Death or Glory Boys', all the tanks of 17th/21st Lancers carried the regimental motto on the door of the TOGS barbette and, during the final dash to the Kuwait-Basra highway, Four One flew a lancers' pennant from the radio antenna.

the operation had been… Rumours of future operations were rife. We were all desperately enthusiastic to close with the Republican Guard and have a crack at a T-72. The warning order that day suggested we would sweep up the Kuwait/Iraq border to the Republican Guard, the limit of exploitation being the Euphrates, an exciting possibility which unfortunately was not to happen… The Squadron

> adopted its night-time routine. The World Service broadcast the possibility of a ceasefire which was met with mixed emotions.
>
> 28 February, the fifth day, G+4. During night of G+3 talk of ceasefire. At 0600hrs QRIH ordered to move due east 30km to blocking position. Task to cut the Basra road north of Kuwait City on Line Lance within Objective Cobalt. Challengers thundered forward. At 0647hrs saw an abandoned ZSU-23-4 on a road. At 0725hrs B Squadron reached Objective Cobalt. We received warnings of chemical antipersonnel mines and anti-tank mines. One tank crew saw a dog trigger a mine during the approach to the objective.

The war diary of the QRIH covering the final advance to Objective COBALT reads as follows:

> At 0424hrs Brigade issued orders. The ceasefire would be delayed from 0500 to 0800hrs. The Brigade H-hour to advance on Objective COBALT, the Basra Road, was set for 0630hrs At 0509hrs RHQ ordered the Regiment to pack up and be ready to move at any time. At 0600hrs the Regiment moved, B Squadron leading, A Squadron left and D Squadron right. The Regiment was to charge, destroying all enemy en route. At COBALT the Regiment was to secure the area and cut of the Iraqi retreat on the Basra Road. The weather was overcast, the smog from the oil fires blackening the sky and a thick fog had rolled in, reducing visibility to 400 metres or less. The Regiment had covered over 40 kilometres in bad visibility at terrific speed. It had arrived at the Basra Road and seen the devastating effect of modern airpower. The road was littered with destroyed vehicles, both military and civilian. It was an apocalyptic sight.

Captain Tim Purbrick of the 17th/21st Lancers described the final hours of Operation Desert Sabre to this effect:

> One minute we were fast asleep the next it was dawn and everyone was shouting. The Immediate Action Drill for this eventuality is to get your kit packed and yourself back into your crew position as quickly as possible and then find out what the hell was going on. It was madness. Tanks were firing up their engines all along the line. Columns of blue-black exhaust smoke shooting diagonally up into the air from the tanks' twin exhausts. Turbos screaming and turret systems coming on-line. Brew got the tank started.
>
> Pete flicked the radio systems into action. Gus got the Gun Control Equipment warmed up. I reached into the turret and pulled out my helmet with its integral radio fit so that I could start to get some situational awareness. Were we under attack, were we moving, where to and why? In minutes the whole Squadron was all on board in their crew positions.
>
> Either side of me Brad and Urby gave me a thumbs up. We were ready to go and fight. I looked left and right down the Squadron line. It was a similar madness of activity. Tank commanders were gesticulating to each other as if to say 'I haven't got a f***ing clue what just happened but now we're ready to go, what is it all about?
>
> Toby gave a quick set of battle orders. The Armoured Regiments of 7th Armoured Brigade are to advance in line to secure the road from Kuwait City to Basra and we were to do it before the UN deadline for the cessation of hostilities. What deadline? What time for the cessation of hostilities? This was news to us frontline mushrooms

– kept in the dark and fed on shit. Apparently, some bright spark in the White House had come up with the catchy '100 Hours War' phrase.

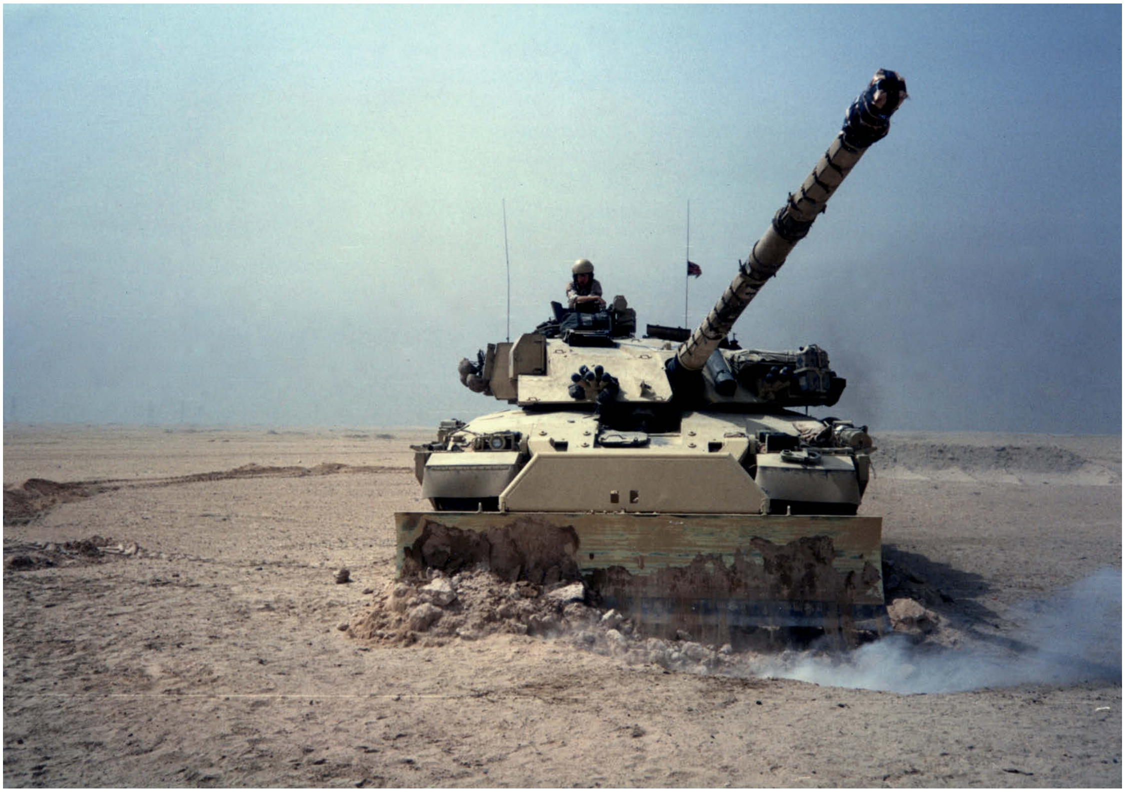
Now we had no time whatsoever – an hour – to cover the 40km from our current position to the Basra Road before the expiry of the deadline. 'Four Zero, you're point navigator,' ordered Toby. Outstanding. On the point for the Squadron for a 40km cavalry charge. I plugged the eastward waypoints into the Trimble. 'Go, Brew, go'. We accelerated out of the line, Brad and Urby either side of me. 'Go f***ing where, boss?' 'Turn right and go straight. I'll keep you straight'. Brew pulled a right stick and we came round to face the east. I glanced rearwards through my episcopes. The rest of the Squadron was falling in either side of me and slightly to the rear in a flat arrowhead with Squadron Headquarters tucking in behind me. We accelerated away to the east.

Tank engine roaring in the background, gear changes and rattling of turret equipment, It's now zero seven hundred on the 28th. We came into that fire position that I described yesterday and we suddenly had orders in the middle of the night to move very, very fast eastwards to put in a VCP (Vehicle Check Point) and investigate a barracks and we're doing that now. Four Zero is the point at the moment and we are making our way quite swiftly eastwards. We are passing a number of defensive positions which are lorry-borne troops. Lorries all abandoned. Nobody is around here at all. We have just come over a road where an abandoned BMP was. We're cracking on.

'We've got to really go for it', came the orders from Battlegroup and Squadron HQ. Even better. 'Pedal to the metal, Brew.' The turbos lit up and the tank leapt forward. The desert was hard. Almost as good as the highway. I looked left and right down the line. Squadrons to the left of me. Squadrons to the right of me. Yea, into the Valley of Death went the 600. It was the charge of the Light Brigade all over again, 137 years later. This time we had swapped our one-ton beast of burden, lances and sabres for a 62-ton mechanical monster with a 120mm main armament and two 7.62mm machine guns. Far from being the Light Brigade we were definitely the Heavy Brigade.

The weather was clear and sunny. There were no enemy guns so far. I kept glancing down at the Trimble. It gave little arrows to show whether we were left or right of

Operating in full NBC kit was inherently difficult during Operation Desert Sabre so once the chemical threat from Iraqi forces receded so gasmasks and gloves were discarded but NBC suits remained because of the freezing cold conditions during the land battle.



The Challenger can be fitted with the Pearsons Engineering Universal Dozer Kit or UDK for general bulldozing duties. Normally issued to the second in command of an armoured squadron, the UDK can dig a hull down tank scrape in approximately ten minutes. This Challenger Dozer of the Queen's Royal Irish Hussars is filling in a trash pit during Operation Granby in January 1991.

track. 'Left a bit.' 'Right a bit.' Inside the turret everything was vibrating with the speed of the tank. It was being shaken apart. We crossed a few incongruous tarmac roads. We saw Iraqi vehicles. All of them destroyed. We weaved in and out of a bunker position. Off to a flank James Moseley's tank sank gracefully through the roof of a bunker and there he stayed for the rest of the war, literally.

We kept going east at full pelt. 40km/h. But this was no Valley of Death. It was a straightforward, old-fashioned charge. It was hugely exhilarating. None of us had ever envisaged when we started our military careers in Munster that we would take part in the longest and fastest modern-day cavalry charge. More than a hundred tanks in almost line abreast, charging to the east. If there had been any Iraqis in front of us, it would have been a truly awesome and frightening experience. The ground shook like an earthquake. Clouds of desert dust and exhaust dust billowed up behind the tanks. At the base of the clouds, small black dots, gradually becoming larger and then suddenly, they were tanks. We would have swept straight over any resistance like a steel tsunami, without hesitation, without break.

As the distance between us and the Basra Road counted down, so did the minutes to the deadline for the cessation of hostilities. The pollution clouds billowed in again, reducing visibility to only a few hundred metres. We slowed but maintained our movement eastwards. We were nearly on top of the highway now. A Gazelle recce helicopter materialized out of the smog on our left flank, flying at no higher than the turret of a tank. A couple of Iraqi soldiers appeared out of the murk. They were old men in greatcoats waving their hands above their heads and walking around in a dazed manner. Perhaps they had been the victim of one air strike too many or maybe they had been abandoned when their unit had pulled out. We bypassed them.

Over the radio came the shocking news that a US A-10 Warthog tank-buster had taken out a Warrior killing a number of British troops. A Warrior would not have stood a chance against an A-10. It was armed with air-to-ground armoured-vehicle-killing Maverick missiles and a 30mm Gatling gun firing depleted uranium-tipped, milk bottle-sized rounds which would have ripped open an Armoured Personnel Carrier. The frustration and rage was huge. So far the only battle casualties that we knew about had been ones that we had from being shot up by our Allies.

At a brief halt, and despite the still-present clag all around us, soldiers could be seen out on their turrets adjusting the large day-glo air recognition panels fixed across the rear bins of their tanks. Others broke out the Union Flag and the Irish Tricolour and attached them to their radio antennas. Anything to make ourselves visible to the death to our sides and to the death above us.

Instead of Lancer pennants pointing at the enemy as they had at the Charge of the Light Brigade in 1854, our pennants now pointed skywards as a warning to a pilot at 8,000ft. It was almost a medieval display of pageantry. The wind changed again and the pollution blew away to somewhere else leaving us to drive up the highway embankment and cross the Basra Road in clear sunshine. Disappointingly there was nothing on the road. No convoys of retreating Iraqi troops to shoot up. Just a few burnt-out vehicles on either side of the highway. But we had made it by the deadline. Objective secured.

It's now half past eight on the morning of the 28th and we have moved about forty Ks eastwards into Kuwait to intercept the main MSR. The whole Division appears to be moving into quite a small area. On the ground there are quite a lot of shell scrapes. Now we're waiting in a big circle waiting for the other call signs to catch up with us.

Was that it? The 100 Hours War? Or, would we get new orders to turn north and advance back into southern Iraq? We continued our advance eastwards but now at a walking place as if we were looking for a place to hold hard. Ahead the desert dropped away and I could see massive electricity pylons marching away from us. Their huge cables lay uselessly broken on the desert floor, victim of an air attack or maybe Iraqi sabotage.

We drove into an abandoned Iraqi artillery position. The guns had been left in place but all the blokes had gone. There were plenty of tank positions set up with small, low sand walls around them. They wouldn't have stopped a tank round. Trench systems abounded but they looked shallow and had poor overhead protection. They would have been utterly useless against air or artillery and would not have given us any trouble either. But surely the bombardments of the last month would have encouraged the Iraqis to dig deeper and to improve their protection? Perhaps the position had been abandoned before the air war started. But, why had they left their artillery in place then? It was all a bit inexplicable. Strange things happen in war and this position was one of them. We came to a halt more or less on the position.

OPPOSITE The commanding officers of the Royal Scots Dragoon Guards and the Queen's Royal Irish Hussars confer in front of their Challenger Mark 3 Command Tanks at the conclusion of Operation Desert Sabre. The 1st (UK) Armoured Division advanced 290km in 66 hours; destroyed three Iraqi divisions; took 7,024 prisoners; captured over 400 equipments and 2,000 small arms: 50x T-55; 61x T-59; 13x T-62; 104 other A-Vehicles; nine missile systems; 69 B-Vehicles; and 242 artillery and anti-aircraft weapons. The Challenger MBTs of 1st (UK) Armoured Division suffered no damage or loss to enemy action. It was a consummate victory by any measure.

Major Nigel Beer, C Squadron Leader QRIH, was to say later:

> If the advance to Objective Varsity could be described as a canter the advance to Objective Cobalt was a gallop. The Regiment was to be the point Battle Group of the Brigade and the Squadron the point of the Regiment. Speed of movement was of paramount importance. We were given 15 minutes to get going across the Start Line. As orders were being relayed, the Squadron instinctively moved into its leaguer formation and began to advance. Things happened so quickly that it was in fact only after we had crossed the start line that the full details of our task were passed down.

We covered 45km in the first hour… The satellites went down for a short period of time and we quickly reverted to the compass which worked remarkably well. It was a good morning for the Squadron. At one point we were 9km ahead of the Regiment! In different circumstances this might have been rather risky but the race was on and the Colonel was just behind us… The Squadron advanced to the road. It was a miserable but memorable sight. A deserted motorway with destroyed and abandoned military vehicles scattered about. Early sightings by 1st Troop reported tanks on transporters withdrawing, however, as we closed, it became obvious that they had already been destroyed. There were no signs of a retreating army but in retrospect the carnage of the Mutla Ridge to our south may well have prevented that retreat. The Squadron crossed the road and took up defensive positions facing east. There was much concern about the possibility of anti-personnel mines around our vehicles, so for the time being crews remained mounted. At 0800hrs the ceasefire came into effect. Guns were cleared and brews were made as we awaited further orders… The Squadron had driven some 300km since entering southern Iraq and by-passed or engaged elements of between four and five Iraqi divisions. This was a major achievement, although we were frustrated at not having met the Republican Guard… However, we were luckier than they. We were all still in one piece.

CHAPTER 5

CHALLENGER 2

By the mid-1980s, the Soviet Union was producing over 3,000 MBTs a year. Increasingly powerful models, such as the T-64 and T-72, were being introduced that posed a significant threat to the British Army's mixed fleet of Chieftain and Challenger MBTs. Accordingly, the Chieftain/Challenger Improvement Programme (CHIP) was implemented primarily to modernize their turret ergonomics and fire-control systems. Concurrently, the CHARM or CHieftain/CHallenger ARMament programme was underway to develop a new high-performance 120mm rifled gun, the XL30E4, and improved ammunition for both the existing 120mm L11 series and the new tank gun. In addition, a separate up-armouring programme designated Stillbrew was introduced for Chieftain to thwart attack from the 125mm main

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armament of the T-64 and T-72. The CHIP and CHARM programmes were to be applied to both Chieftain and Challenger pending the introduction of a new MBT before the turn of the century.

Several options were proposed to the Equipment Policy Committee, including further purchases of Challenger, together with a comprehensive product improvement programme for the complete Challenger fleet. The purchase of a foreign MBT such as the M1 Abrams or Leopard 2 was also considered, as they were mature designs and the adoption of either would enhance NATO interoperability due to the fact that they both employed a mutually compatible 120mm smoothbore main armament. In November 1986, General Sir Richard Vincent, the Master General of the Ordnance, visited Vickers Defence Systems (VDS) in Newcastle-upon-Tyne to investigate whether the company could suggest a replacement MBT for the 986 Chieftains then in service. The design concept was begun immediately, based on a combination of a revised Vickers Mark 7 turret and an upgraded Challenger chassis – the Mark 7 being a private VDS design offered on the international market. The first official presentation of the Challenger 2 by VDS to the Ministry of Defence (MOD) occurred on 30 March 1987 at Millbank Tower, the head office of Vickers plc, overlooking the River Thames in London.

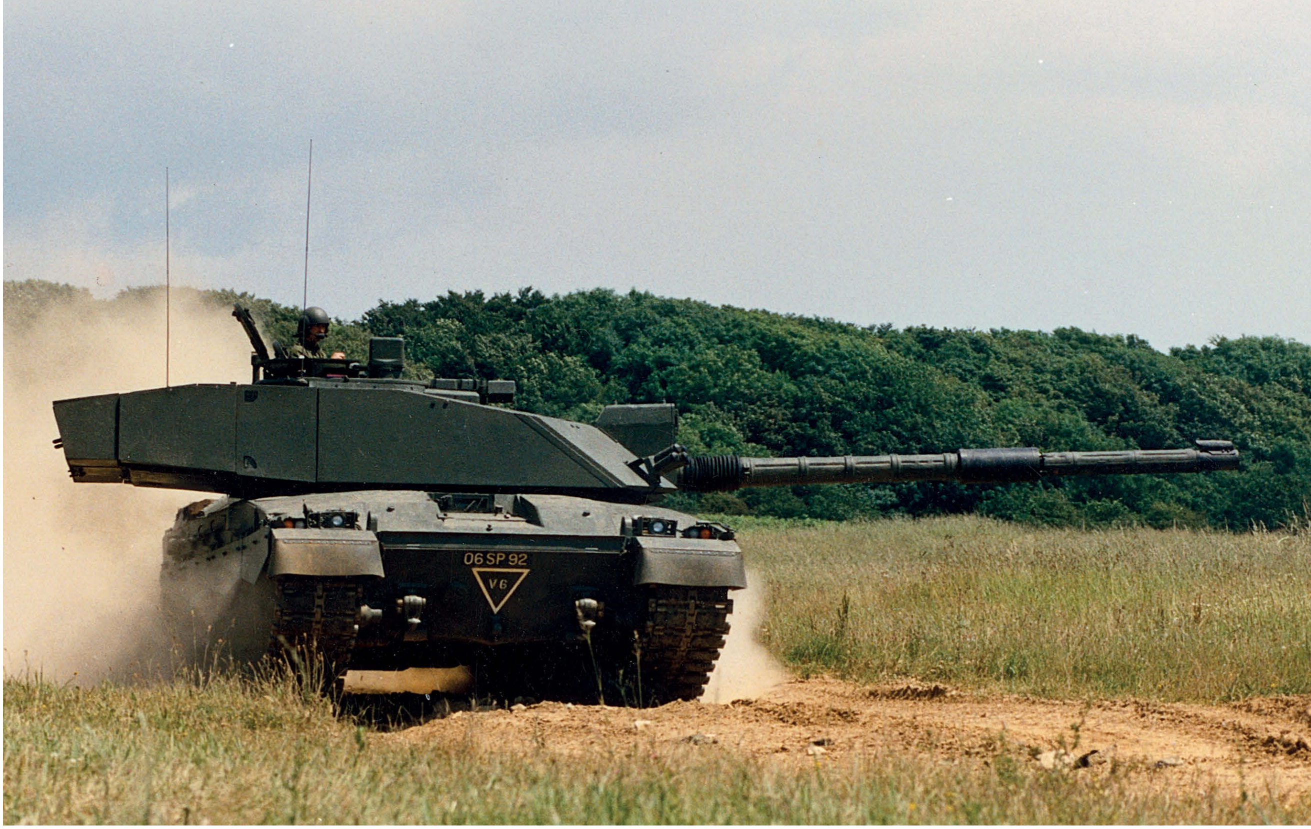
DEVELOPMENT

STAFF REQUIREMENT (LAND) 4026

Following the disastrous CAT ’87 NATO tank gunnery competition in which Challenger came last, after due consideration, Land Systems Operational Requirements 1 (LSOR 1) promulgated SR(L)4026, the Staff Requirement for the Replacement of Chieftain, on 30 November 1987. The subsequent British Army inquiry held in July identified many failings and equipment deficiencies that required immediate rectification. When compared to the M1A1 Abrams, Leopard 2 or even the Leopard 1, Challenger was demonstrably slower to acquire and destroy targets, particularly when firing on the move or against moving targets. However, neither the M1A1 Abrams nor Leopard 2A4 in their current form fully met the requirements of SR(L)4026. Furthermore, the problems of operating two types of MBTs firing different ammunition, let alone logistic spares, were only too apparent if Chieftain was replaced on a one-to-one basis to serve alongside Challenger. Yet the requirement to replace Chieftain was now ever more urgent given the poor performance of Challenger during CAT ’87, as they essentially shared the same fire-control system. VDS was asked to refine its proposal for the Chieftain replacement programme as a matter of urgency. Having worked throughout the Christmas period, VDS submitted its formal proposal to the MOD on 10 February 1988 – with a further two amended versions during the year – all as a fixed price contract.

The Staff Requirement for the Replacement of Chieftain, SR(L)4026, was quite specific and it could only be fulfilled by improved models of both the M1A1 Abrams and Leopard 2 or a rigorous validation of the VDS proposal for Challenger 2. In effect, all three proposals were paper projects, although those of M1A1 Abrams and Leopard 2 were based on mature in-service designs whereas the VDS one was drawn only from experience with the prototypes of the Vickers MBT Mark 7 and the Engesa EE-T1 Osorio MBT for Brazil, notwithstanding its many years of AFV design and production. However, there were those within the higher echelons of the British

OPPOSITE The first prototype of Challenger 2, 06SP87, stands before the Challenger family with, from left to right, CRARRV, Challenger 1 MBT and the Challenger Training Tank. Although there is a close resemblance between the MBTs, Challenger 2 is essentially a totally new tank. To the crews in the Royal Armoured Corps, both tanks are known simply as Chally.



Prototype V6 roars along a track during a firing run on Bindon Ranges at the Royal Armoured Corps Gunnery School at Lulworth in Dorset. The sophisticated fire-control system of Challenger 2 allows accurate firing on the move out to a range of 2,000m.

Army that wished to brook no further delay and demanded the immediate procurement of their preferred choice. This was the M1A1 Abrams, since the Leopard 2 had been rejected on account of a fundamental design flaw in the armour integrity of the turret front. As such a selection had significant political ramifications, the matter was referred to the Cabinet. The decision to procure an American MBT was rejected out of hand by Prime Minister Margaret Thatcher. She instructed the MOD to think again.

VICKERS DEFENCE SYSTEMS CONTRACT

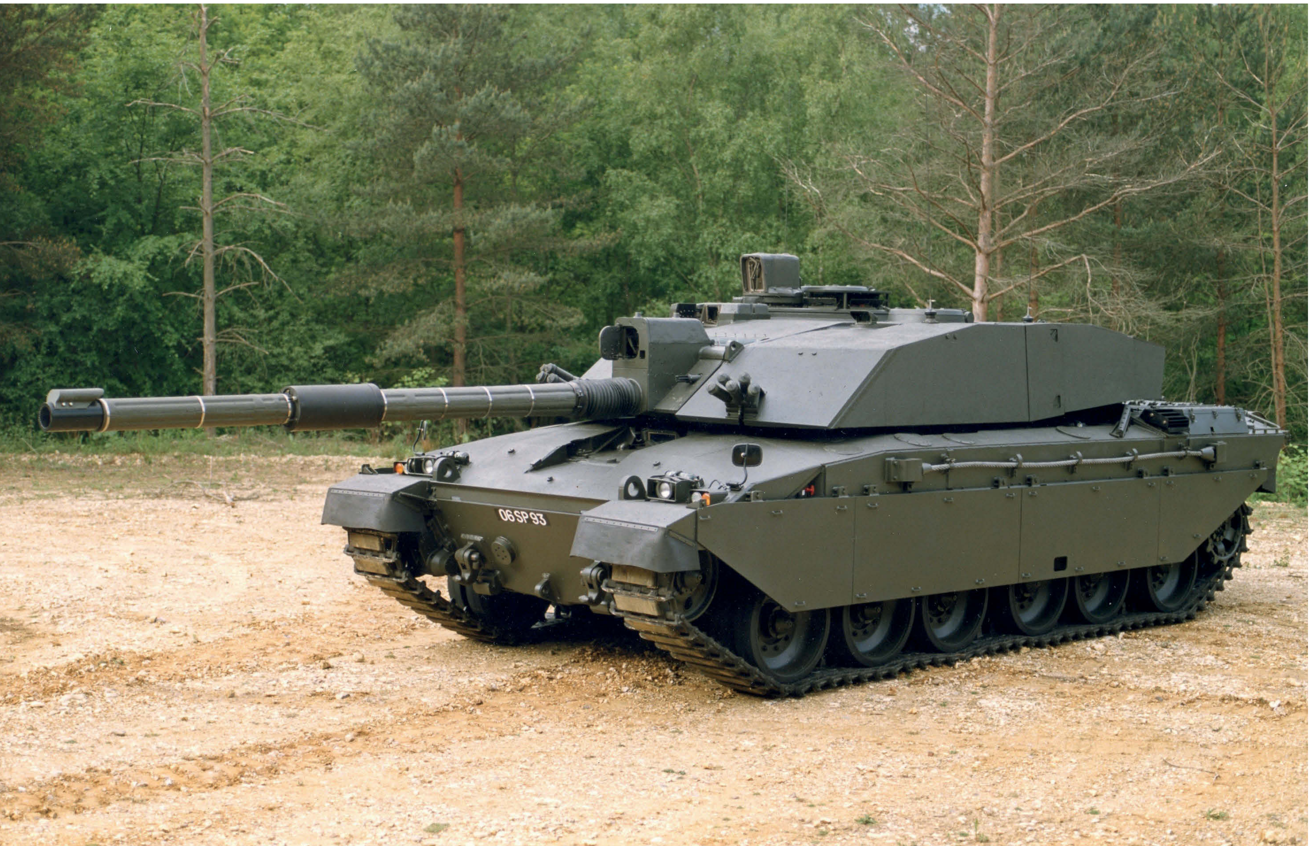
On 20 December 1988, the Secretary of State for Defence, George Younger, announced to the House of Commons that, in order to give VDS an opportunity to demonstrate that their proposal could meet SR(L)4026, the company was to be awarded a £90 million contract to undertake a 'demonstration phase' lasting 21 months. The 'proof of principle' contract was signed on 20 January 1989. VDS was given a specific set of criteria for the overall vehicle performance against which the success of the demonstration phase was to be measured. The criteria covered such aspects as reliability, maintainability, survivability and, especially, fightability. Essentially VDS was required to demonstrate that its Chieftain replacement could 'be successfully developed and produced to the required standard so as to achieve the required in-service date, and at a price which the company has already offered'. Within the contract, there were three specific 'milestones' to assess actual progress. The set dates fell in September 1989, March 1990 and the final one on 30 September 1990, when the company was required to answer 11 specific questions about the potential performance and capability of the offered product. These were known as 'The Eleven Commandments' and they had to be met before Challenger 2 could be evaluated with the other contenders as the prospective Chieftain replacement.

As part of the agreement, VDS became responsible as prime contractor for the CHARM programme, then under development by Royal Ordnance. CHARM 1 embraced the design and development of the high-pressure XL30E4 120mm rifled gun and the XL26 APFSDS projectile with a depleted uranium (DU) long rod penetrator. The combination of the L26 fin round and L14 propellant charge was used to devastating effect by Challenger MBTs armed with the L11A5 120mm gun during the Gulf War of 1991. CHARM 3 comprised a new DU APFSDS projectile – L27A1 with a new propellant charge L16A1 (later L17A1) – that gave a 25 per cent greater penetration capability than the L26 round, together with the necessary sighting, racking and storage items for Challenger 2. In its definitive form, the L30A1 120mm rifled gun became the main armament of Challenger 2. At this stage, the intention was to retrofit the weapon to all 420 Challenger MBTs to give commonality across the complete tank fleet.

FOREIGN COMPETITORS

The basic requirement was for 600 MBTs to replace Chieftain and serve alongside the fleet of 420 Challengers. As Chief of Defence Procurement for the MOD, Sir Peter Levene decreed that, in the interests of a free market, the Chieftain replacement programme would be open to those tank-manufacturing countries producing models that could fulfil SR(L)4026 within the given timeframe. At the outset, there was little response to the 'invitation to tender' as no tank-producing country had ever held an open competition before that might damage or compromise its own tank manufacturing industry. None of the European manufacturers or the United States really believed that the competition would be fair and open. None of these countries would ever hold such a competition themselves so it was seen as a paper exercise and not worth making any significant investment for.

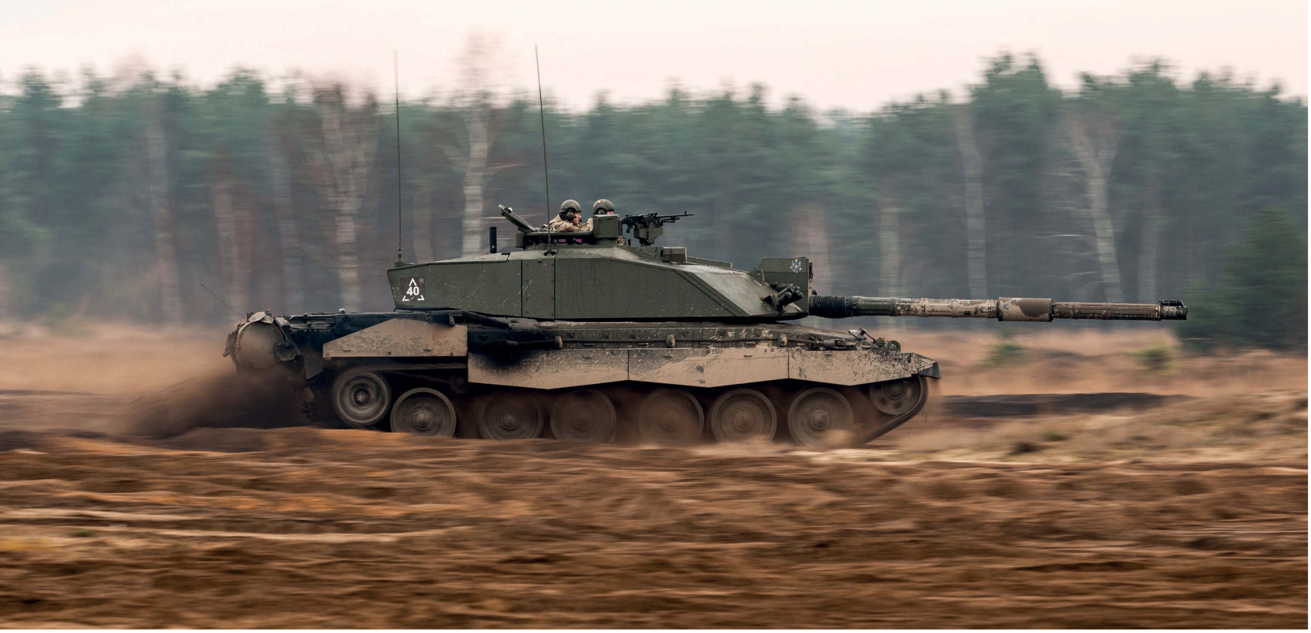
06SP93, or prototype V7, displays to good effect the main armament of Challenger 2 – the 55-calibre long L30A1 120mm rifled gun. Above the barrel is the barbette housing of the Thermal Imaging System (TIS) that is an improved version of the one fitted to Challenger. This device provides outstanding night vision to both the commander and gunner, as well as in bad weather or through battlefield smoke.



The crew of a Challenger 2 of Badger Squadron Royal Tank Regiment prepares their MBT for a night firing exercise at the Castlemartin gunnery ranges in South Wales. The two final tank regiments combined as a single entity on 2 August 2014 to become Royal Tank Regiment: one of only three remaining armoured regiments within the British Army.

Nevertheless, both Krauss-Maffei and General Dynamics Land Systems (GDLS) submitted proposals for the Chieftain replacement programme in August 1987. The Krauss-Maffei entrant was an improved version of the Leopard 2A4 (subsequently designated Leopard 2A5) with a new wedge-shaped turret front that overcame the weakness of previous models as identified by the British, as well as other enhancements. At this time, the Leopard 2 Improved was still under development. The GDLS entrant was the M1 Block 2 (subsequently designated M1A2). Again, this model was under development with the first prototype appearing in July 1990. Both tanks were armed with versions of the Rheinmetall 120mm smoothbore gun firing mutually compatible types of ammunition.

Following a series of high-level meetings between British civil servants and military officials with their American and German counterparts in April 1990, GDLS and Krauss-Maffei were persuaded that all the entrants were to be examined thoroughly and fairly as to whether they fulfilled the requirements of SR(L)4026. Both companies then submitted more detailed specifications for their respective tanks, as well as their current production models for initial testing. Both proposed designs were of conventional layout with a four-man crew, similar to Challenger 2, and both featured a commander's independent stabilized panoramic sight that allowed what was then termed the 'hunter-killer' target surveillance and engagement procedure. In essence, the commander surveys the battlefield through his 360-degree panoramic sight. On spotting a hostile threat, he then switches from a wide field of view to a narrower one at a higher magnification to lay his aiming mark on to it and identify the target positively. He then fires his laser to provide the fire-control computer with the information it needs to calculate a firing solution. The commander then presses a switch that automatically aligns the turret and gun to the precise point of view that is now stored in the fire-control computer. This allows the gunner to engage the target immediately without having to 'lase' the target again. Meanwhile the commander has started the engagement sequence against a subsequent target. In this way multiple targets in different directions can be engaged and destroyed rapidly with the minimum of time. In these politically correct times, the term 'hunter-killer' is no longer used in the Royal Armoured Corps and the designation 'battlefield management' is preferred.



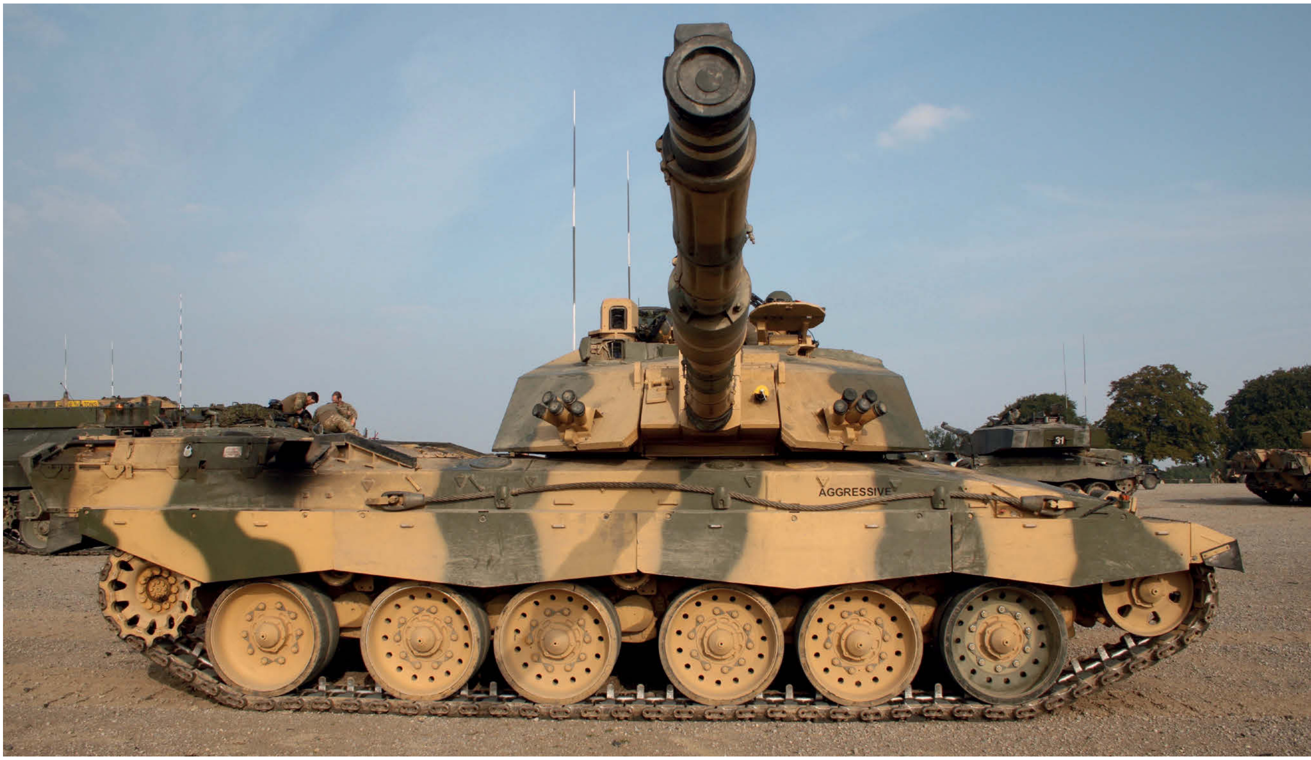
Under the concept of Whole Fleet Management, the great majority of Challenger 2 MBTs are now stored and maintained by an outside agency so each armoured regiment has just a few for everyday training. Tanks are allocated as required for field exercises with significant restrictions as to their use. Thus, crews are no longer able to individualise their tank with names, regimental crests or any other adornment, although this crew of The King's Royal Hussars have added a regimental zap to the TISH housing during an exercise at the Drawsko Pomorskie Training Area in Poland. Accordingly, tanks are starkly plain with only the vehicle callsign visible on the exterior. The notion does not enhance crew or unit cohesion but satisfies the 'bean-counters'.

Besides the two above contenders, GIAT of France subsequently proposed the AMX Leclerc MBT as an entrant in the Chieftain replacement programme. Compact and highly mobile, this innovative design featured an automatic ammunition loading system and a three-man crew of commander, gunner and driver. The Leclerc was included in the competition more out of a sense of European solidarity than expectation, as the Royal Armoured Corps has little faith in automatic loaders or the concept of a three-man crew. In the meantime, in late 1987 VDS began the construction of a number of turrets using company funds, initially £5.6 million, with the first one completed during autumn 1988. At the same time, numerous subcontractors were approached as industrial partners with these companies committing approximately £20 million of private money at their own risk in the project. Following the signing of the 'proof of principle' contract on 20 January 1989, the manufacture began of nine Challenger 2 prototypes and a further two turrets: one as a weapons test rig and one for 'attack on armour' trials.

CHALLENGER 2 PROTOTYPES

The nine prototypes were built at the new Barnbow Works in Leeds. All were completed by 30 September 1990, on schedule and within budget for the competitive phase of the Chieftain replacement programme. This was to run from October to the end of the year, when the winner would be announced. During this period, VDS was to receive a 'bridging contract' from the MOD prior to a full development and production contract in January 1991 if Challenger 2 won the competition. It must be stated that this was not to be a comparative competition between the four contenders as to the 'best' tank overall but to identify which most closely fulfilled the specific requirements of SR(L)4026. Each contender was to be trialled by a separate dedicated team of British Army personnel with experienced crews from each of the companies. No team was to have any contact or dialogue with another and all data was to be assessed by a different body entirely in the interests of fairness and thoroughness.

In the event, the comparative trials were not held in 1990 on account of the Iraqi invasion of Kuwait on 2 August. The whole resources of VDS were now devoted to the support of the Challenger fleet and 7th Armoured Brigade that was deployed to Saudi Arabia as part of Operation Granby.

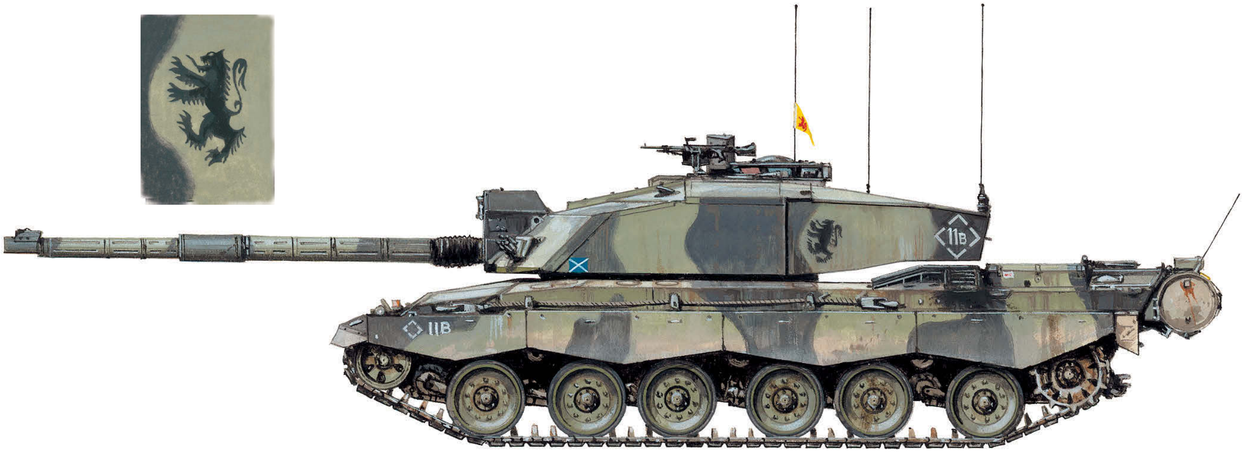


With the apposite name AGGRESSIVE emblazoned on the hull sides, a Challenger 2 of A Squadron 1st Royal Tank Regiment prepares for an exercise on Salisbury Plain Training Area in September 2013. Note the two patterns of roadwheels with the latter type having perforations inside the wheel rims.

OPPOSITE The employment of heavy armour in urban fighting has always been deemed an inappropriate use of such AFVs but it has become more commonplace in the recent upsurge in asymmetrical warfare. The key to success is the closest cooperation between tanks and infantry in their IFVs. Here, a Challenger 2 of The King's Royal Hussars takes part in Exercise Lion Strike at the Copehill Down FIBUA facility and Close Quarter Battle Training Centre on Salisbury Plain in July 2014.

In its report on the war, the House of Commons Defence Committee stated: 'The tank was the decisive battle winner of the land forces campaign and the British Challenger force in the 1st (UK) Armoured Division made an important contribution to this success'. In response to a question on 19 March 1991 in the House of Commons, the Prime Minister John Major declared: 'The Challenger tank performed absolutely magnificently in the Gulf – far above the expectations that anyone could have had of it.' However, despite these ringing endorsements, the decision as to the Chieftain replacement had still to be made. The situation was compounded by the fall of the Berlin Wall and the collapse of Soviet authority across the countries of Eastern Europe that had formed the Warsaw Pact. The very rationale for the heavy MBT was called into question despite its undoubted success in the Gulf War. Although the Chieftain replacement was a 'core project' and the Treasury had authorized its full funding, there remained considerable debate as to the total number of tanks required for the British Army following the Strategic Defence Review.

The comparative evaluation of the four contenders was duly held in the spring of 1991. All four excelled in one aspect or another but for the reasons stated above the Leclerc was eliminated. The three others met the requirements of SR(L)4026. Within the British Army, particularly the Royal Armoured Corps, there was an influential faction that was seduced by the notion that German engineering was superior to any other. Dubbed the 'BMW syndrome', it was sufficient to create a body of opinion that favoured the Leopard 2 Improved. Although Challenger 2 was perceived to have greater survivability and many other attributes, the Leopard 2 Improved was assessed to have lower 'whole life costs' overall, always a matter of utmost concern to the Treasury. Others still endorsed the M1A2 Abrams, so the Defence Procurement Agency passed the matter to the government.



CHALLENGER 2 COMMAND TANK, REGIMENTAL HEADQUARTERS, THE ROYAL SCOTS DRAGOON GUARDS (CARBINIERS AND GREYS), EXERCISE ULAN EAGLE, POLAND, OCTOBER 1999

The Royal Scots Dragoon Guards was the first armoured regiment to be equipped with Challenger 2 and the first to use it on field training exercises in Canada and Poland. One One Bravo was the command tank of the commanding officer, Lieutenant Colonel Andrew Philips, during the 7th Armoured Brigade field training exercise conducted at Drawsko Pomorske Training Area in Poland during October 1999. The tank is painted in the standard British Army camouflage scheme of black stripes over a base colour of dark green. As a reflection of their antecedents, the Carbiniers and Greys, all the tactical markings such as the callsign One One Bravo are painted in grey as is the Lion Rampant on the turret sides to denote the CO's tank. The Lion Rampant is also flying from the radio antenna. As a command tank this Challenger 2 has an extra HF radio set and antenna but as a deliberate *ruse de guerre* to disguise command and control tanks, all Challenger 2 MBTs in the British Army carry three radio antennae at all times. Low down on each side of the turret front is a diminutive cross of St Andrew – the Saltire – as the SCOTS DG is known as 'The Scottish Cavalry'. The Vehicle Registration Number (VRN) 66KK82 is displayed centrally on the front lower hull plate and at the top right of the rear hull. On each side of the front VRN is a small black rectangle with a vehicle 'zap code', 400, superimposed in white. Centrally on the rear hull plate above the towing bar is the convoy distance marker, consisting of an illuminated square with alternating black and white stripes, which allows the driver of a following tank to maintain a safe distance at night.

THE CHOICE OF CHALLENGER 2

The final decision as to the Chieftain replacement lay with the Cabinet. There were numerous aspects to consider. First and foremost was the question of numbers following the Strategic Defence Review. This was exacerbated by a financial shortfall in the MOD's 1991 Long Term Costings for equipment procurement, and it led to a significant scaling down in the number of new tanks that was affordable in the short term. This now precluded a whole fleet replacement of both Chieftain and Challenger. The Americans and Germans were furious at what they perceived to be a change in the rules, but the original requirement had always been for a replacement for Chieftain to serve alongside Challenger and the new strategic geopolitical situation following the collapse of the Iron Curtain was an unforeseen circumstance. Therefore, the argument for interoperability of a smoothbore main armament with Britain's NATO partners was deemed no longer valid without a full fleet replacement. Ministers concluded that Britain's operational contribution to ARRC (NATO Allied Rapid Reaction Corps) would be stronger by maintaining interoperability between Challenger and the new tank, as the intention was always to rearm Challenger with the L30 120mm high-pressure gun. It was a key factor in their final decision.

There were also the financial implications of purchasing fewer tanks, particularly a foreign one. With fewer than 500 tanks, co-production became a less viable financial proposition. For Leopard 2, Krauss-Maffei estimated that up to 60 per cent of the tank could be produced locally before unit costs rose significantly. But the Swiss Army experience suggested otherwise. In a total procurement of 380 Leopard 2A4 MBTs, 345 were built under licence in Switzerland, but it took two years of separate contract negotiations with each subcontractor before manufacture began, which raised the unit cost by at least 25 per cent over the original price as well as a delaying its entry into service with the Swiss Army. Inevitably, it would lead to a loss of jobs in Britain's tank-manufacturing industry with its many subcontractors dotted across the country in

The combined firepower of a battle group at BATUS is formidable and represents the combined arms of artillery, tanks and mechanized infantry including MLRS, AS90, Stormer air defence vehicles, Challenger 2 tanks and Warrior IFVs as well as extensive Royal Engineer and Royal Electrical and Mechanical Engineer support.

marginal constituencies. The Conservative government was acutely aware of the loss of tens of thousands of jobs in the manufacturing industries of the North over the previous decade, particularly on Tyneside. In addition, there were dark mutterings at Vickers as to whether the company would be party to any co-production deal at all if it should fail to win the competitive procurement process. Finally, the opportunity to sell British tanks on the international market would be lost forever, despite the fact that no country had purchased Challenger.

THE POLITICS OF DEFENCE PROCUREMENT

All major weapons procurement programmes have a significant political dimension; at over £2 billion, the Chieftain replacement programme was no exception. After the recent Nimrod Airborne Early Warning (AEW) aircraft fiasco that wasted billions of pounds, the British government was determined to obtain value for money through an open competition. The failure of Nimrod AEW obliged the Royal Air Force to purchase the Boeing E-3 Sentry system that would have been significantly cheaper in the first place. It is a prime responsibility of government to procure the most effective military equipment at the minimum cost to the taxpayer. Nevertheless, the remarkable performance of Challenger during the recent liberation of Kuwait could not be overlooked, nor could the wholehearted support by Britain's tank-manufacturing industry throughout the crisis. Furthermore, the Gulf War was deemed to be a complete vindication of the British philosophy of tank design whereby heavy armour protection for the crews and devastating firepower to engage and destroy hostile AFVs at long range were the primary attributes of an MBT. However, all the contenders showed such characteristics.

The Cabinet subcommittee tasked with making the final decision comprised the Prime Minister John Major, the Defence Secretary Tom King, the Foreign Secretary Douglas Hurd, and the Trade and Industry Secretary Michael Heseltine. Initially, the

Prime Minister questioned the need for a new MBT at all given the changing geopolitical situation in Eastern Europe and the pressure on public spending, notwithstanding the recent embarrassing defence procurement failures highlighted by the National Audit Office. The Defence Secretary expressed the view that there were no significant defence reasons to make a particular recommendation. The Foreign Secretary remained neutral beyond stating that the export of Challenger 2 to the Middle East could lead to some foreign policy benefits.

Only Michael Heseltine as the Trade and Industry Secretary expressed strong views on the subject. He argued forcibly that an indigenous tank-manufacturing industry gave a nation political kudos in the same way as possessing nuclear weapons. Furthermore, the purchase of a foreign MBT would represent a lack of faith on behalf of the government in Britain's national engineering capability that would send a negative signal to foreign trading partners as to the quality of both the British defence sector and British engineering in general. He also

RIGHT The Challenger 2 features smoke grenade dischargers on the front turret faces to create an instant smoke screen to mask the tank. One other important attribute is the ability to maintain the correct track tension hydraulically from inside the driver's position by adjusting the alignment of the front idler wheels.

BELOW In addition to the smoke-grenade dischargers, the tank can also lay a smoke screen to the rear by injecting diesel fuel into the exhaust outlets of the engine compartment.

The crew of Two One, C Squadron, SCOTS DG, grab a meal during Operation James soon after the extraordinary action they fought in support of Delta Company, 40 Commando, Royal Marines, at Abu-al-Kashib. At the commander's position is Sergeant David Baird while beside him is his loader/operator Trooper Stuart Ferguson and to his front his gunner, Trooper Willie Frazer masking the damage caused by the ATGW strike. With his arm draped round the 120mm is his driver, Trooper Willie 'Mac' Macawai.

highlighted the likely impact on the unemployment figures, especially in the north of Britain, if Challenger 2 was rejected. After due consideration, Challenger 2 was selected by the Prime Minister and endorsed by the rest of the committee with the proviso that VDS be subject to a rigorous set of contract terms and conditions. On 21 June 1991, Defence Procurement Minister Alan Clark announced in the House of Commons the government's decision to select Challenger 2 as the replacement for Chieftain.

Just seven days later on Friday 28 June 1991, a contract was signed between the MOD and VDS for the development of Challenger 2 and subsequent manufacture of 127 tanks to meet the requirements of SR(L)4026. The first batch of 127 was to equip the armoured regiments of 4th and 7th Armoured Brigades, with the remaining vehicles being used for training. The In-Service Date (ISD) was planned to be in late 1993. In addition, 13 Driver Training Tanks (DTT) were ordered with the first deliveries scheduled in 1993. The fixed-price contract worth £520 million specified 23 milestones, all related to achievement during development. It placed the onus of responsibility firmly with VDS as the prime contractor for all aspects of the programme, including training equipment, first-line spares and a comprehensive logistic support package including fielding within the British Army. In addition, there were very tight stipulations concerning achievement of specific levels of reliability, to which some 37 per cent of the stage payments were tied. The first 127 Challenger 2 MBTs were to be equipped with CHARM 1 ammunition while the subsequent issue of CHARM 3 ammunition was planned for 1996 following acceptable user trials. Further orders for Challenger 2 were expected to be placed in batches of 200.

CHALLENGER 2 TRIALS AND TRIBULATIONS

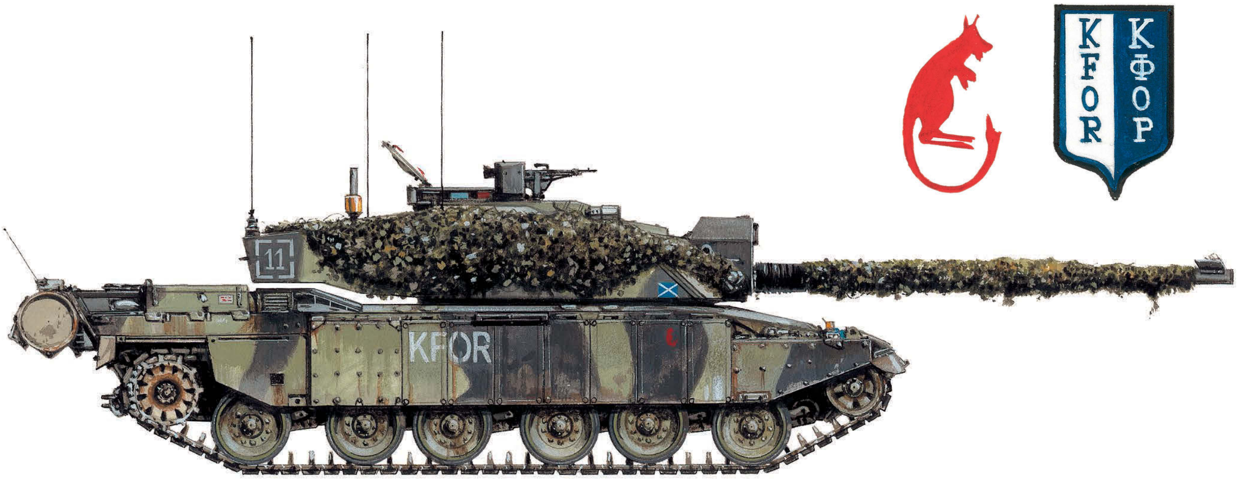
Contracts were now signed between VDS and more than 250 sub-contractors and suppliers throughout Britain and overseas to refine the design of Challenger 2 and allow production to begin. At the same time, the trials and development phase of the Challenger 2 prototypes continued at the Armoured Trials and Development Unit (ATDU) at Bovington Camp, Dorset, the home of the Royal Armoured Corps. These were divided into 'reliability growth trials' and 'user trials' using a combination of service personnel manning the tanks supported by VDS technicians. The nine prototypes were numbered by order of build. Prototype V1 (06SP87) was a general trials vehicle and carried out environmental and other aspects of vehicle performance. It was subsequently bought back from the MOD by VDS and became the base model for Project Copenhagen, the modified Challenger 2 MBT for Oman. Prototypes V2 (06SP88), V3 (06SP89) and V4 (06SP90) were the reliability growth and proving vehicles and did most of the automotive mileage. Prototypes V5 (06SP91) and V8 (06SP94) were the two user trials vehicles. Prototypes V6 (06SP92) and V7 (06SP93) were the firing trials and weapon systems proving vehicles. Prototype V9 (06SP95) was kept to the latest build standard. It was used for sales purposes and often appeared at equipment exhibitions. It became the basis for Project Exmouth, subsequently the Challenger 2E and export model for VDS. It was fitted with production turret No.2, so a further turret was manufactured at the conclusion of the production run. A further two turrets were built: TA1 for rig testing of the weapon systems and TA2 as an 'armour fire-at turret'.

User trials of V5 and V8 were conducted between September 1993 and February 1994. The aim of these trials was to establish whether Challenger 2 fully met the performance specified in SR(L)4026 in the hands of RAC personnel and also give logistic support services, such as the REME, increased experience of the new MBT to help the preparation of drills, training techniques and publications that would be required prior to its entry into service. Most of the trials were conducted at Bovington and Lulworth for the automotive testing and gunnery firing respectively. Suspension and handling trials were also conducted at the Longcross and Hurn test courses. Cold-weather trials were undertaken in the climatic chamber at Chertsey and subsequently at Catterick in Yorkshire for crew cold habitability testing – Challenger 2 was the first British tank with an integral air conditioning and heating system. Tactical assessments were undertaken on Salisbury Plain Training Area (SPTA) and the training phase culminated in a gunnery exercise at Warcop Training Area. Most of these trials were conducted using a system of 'battlefield days' similar to those devised for the concurrent Reliability Growth Trials (RGT).

OPPOSITE Camouflaged in the distinctive green and yellow paint scheme of OPFOR or Opposing Forces, a Challenger 2 of A Squadron 1st Royal Tank Regiment takes part in Exercise Phantom Bugle on Salisbury Plain in September 2013. A Squadron of 1RTR traces its lineage back to the Heavy Branch Machine Gun Corps and is equipped with Challenger 2 MBTs whilst a portion of the regiment is part of the Joint NBC Regiment. A Squadron has 15 tanks, as against 14 in a standard armoured squadron, with the extra one – Zero Delta – in the Squadron Headquarters Troop. Based in Warminster, the main task of the squadron is to provide the heavy armour element for combined arms training on Salisbury Plain.

RELIABILITY GROWTH TRIALS

These RGT were successfully completed in 1994 when three prototypes were tested over a planned total of 285 battlefield days. For the purposes of the RGT phase, a battlefield day consisted of: 27km (17 miles) of road travel; 33km (21 miles) of cross-country travel; the firing of 34 main-armament and 1,000 7.62mm machine-gun rounds with 16 hours of weapon systems operation; and ten hours of main engine idling and 3.5 hours of main engine running at various speeds. During development the Challenger 2 prototypes clocked up 20,400km (12,675 miles) of road and cross-country running and fired 11,600 rounds of 120mm ammunition. The British Army formally accepted the Challenger 2 on 16 May 1994. Nevertheless, the debate continued as to how many Challenger 2 MBTs were to be procured and what



CHALLENGER 2, B SQUADRON, THE ROYAL SCOTS DRAGOON GUARDS (CARBINIERS AND GREYS), OPERATION AGRICOLA 3, KOSOVO, MAY 2000

B Squadron – Beautiful B – of The Royal Scots Dragoon Guards was the first unit to deploy Challenger 2 operationally as the other squadrons in the regiment were acting in the infantry role. The tank is fitted with appliqué armour panels on the sides and front; those on the sides are passive arrays while those on the front are of the ERA type. These are fitted in a warfighting role and are designated Dorchester Level 2. The VRN is displayed vertically on the top right of the rear with a small Union Flag to the left. 62KK80 was commanded by Corporal Andy Potter and the vehicle callsign, One One, is displayed in a stencilled square on the rear turret sides and far right on the rear of the turret. Again, the tactical markings are painted in grey and again the tank carries the Saltire on the turret sides. Camouflage netting masks the turret and main armament. The tank is shown during a road running patrol that was a standard part of Operation Scotsman during the deployment to Kosovo.

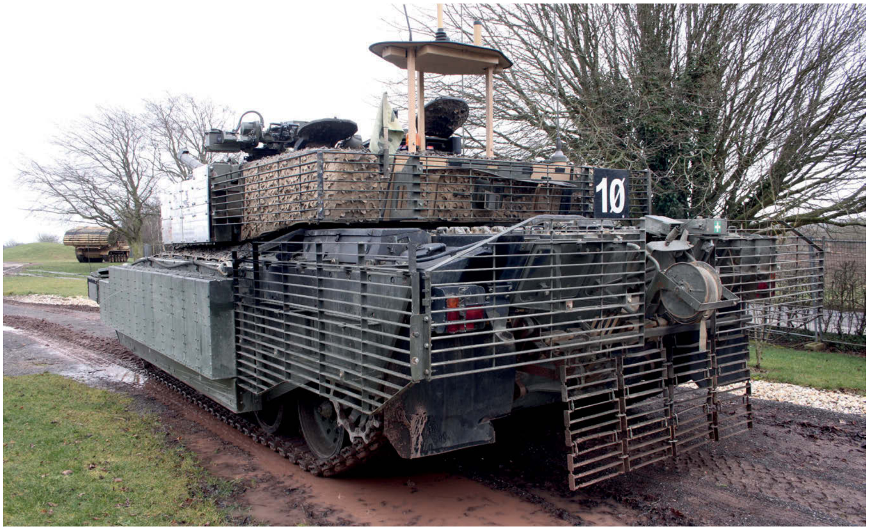
measures were to be implemented for the Chieftain/Challenger Improvement Programme (CHIP). In the event, CHIP was not pursued and it was decided to replace both Chieftain and Challenger with a complete fleet of 426 Challenger 2 MBTs. Due to financial constraints, this number was reduced by 40 to 386. The order for the remaining 259 MBTs as well as nine further DTTs was announced in July 1994.

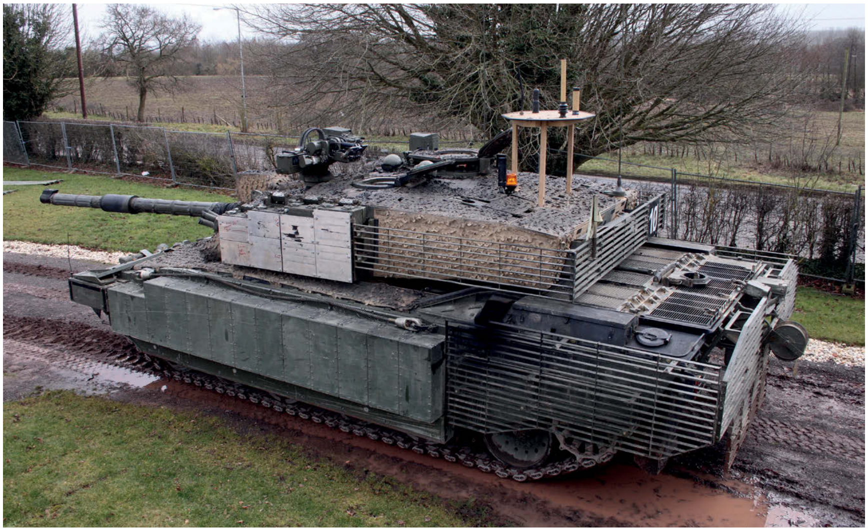
The first production vehicle was completed on 1 August 1994. However, the MOD was determined to ensure that the production models of Challenger 2 met the stringent demands of the original specification. In September 1994, a 'first off production trial' of three of the first six vehicles revealed that VDS had not succeeded in transferring the level of build quality and reliability achieved in the custom-made prototype models to the manufacturing process and the production vehicles. Accordingly, the first batch of tanks was not accepted by the MOD and these were held in storage until the faults were rectified. Inevitably, the original In-Service Date slipped by, much to the dismay of the first armoured regiment scheduled to receive Challenger 2 – the Royal Scots Dragoon Guards. Many armies prefer to introduce a piece of equipment into service and then eliminate any teething problems subsequently. But for Challenger 2 the MOD held VDS to the strict terms of the contract as to quality control and reliability. In time, the problems were solved and modifications made to all the tanks held in store. To achieve this the MOD imposed a series of Production Reliability Growth Trials (PRGT), each with incrementally more difficult reliability targets. PRGT 1 was completed in November 1997 with PRGT 2, 3 and 4 scheduled to be held in March, June and October 1998. In the event the production-line tanks achieved the desired degree of reliability within the first three PRGTs so the last was not held. Even so, the MOD demanded an In-Service Reliability Demonstration (ISRD) of a complete armoured squadron of Challenger 2 MBTs as a final proof of the tank's overall performance.

While laying its own smokescreen, a Challenger 2 equipped with BEMA demolishes obstacles during Exercise Urban Warrior 5 at the purpose-built urban warfare centre at Cenzub in France in December 2012.

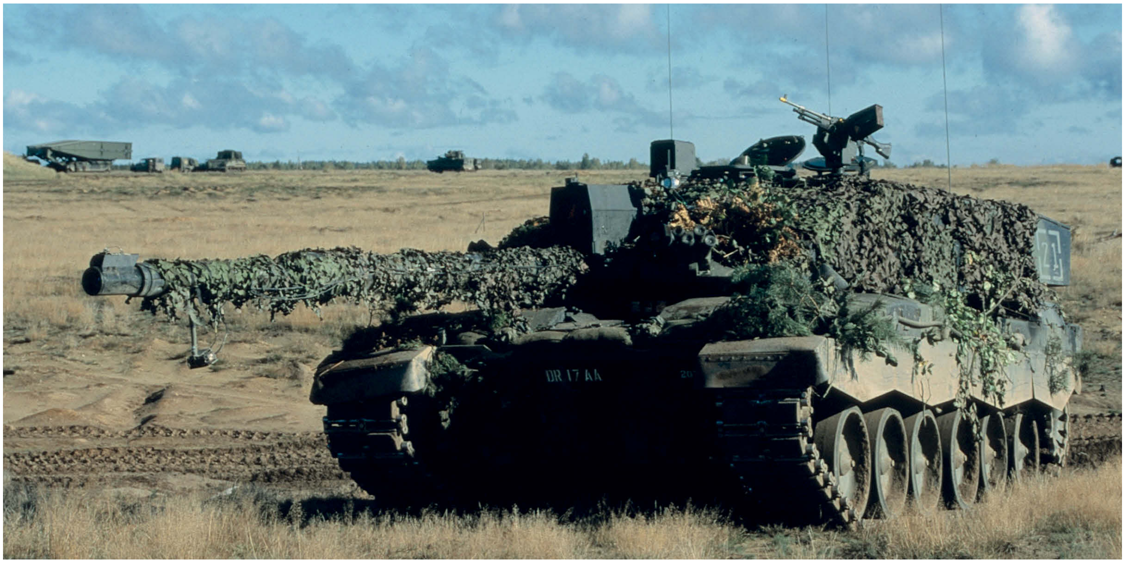
CHALLENGER 2 FIELDING TEAM

From the outset, the Challenger 2 (later AFV) Fielding Team played a vital role in the procurement process; their purpose was to ensure the quality of the tanks as they rolled off the tank transporters and onto the regimental tank parks. Fielding activity was suspended from October 1995 until January 1998 while the Production Reliability Growth Trials were undertaken to improve the quality of the product coming off the assembly lines in Leeds and Newcastle. Once deliveries began in January 1998, the tanks were inspected in batches of 38: the number of Challenger 2 MBTs allocated to each armoured regiment in the Type 38 organization then extant. With a total production run of 386 tanks, the fielding team tested ten batches of tanks over a period of two-and-a-half years. The Challenger 2 Fielding Team was tasked with ensuring the suitability of each and every tank before it was accepted from VDS. The team consisted of an RAC major, a REME ASM and several highly skilled and experienced RAC instructors and REME artificers. Augmenting the Fielding Team staff were crews from the regiment that was to receive the tanks in that





Challenger 2 DT22AA is the reference vehicle at the Armoured Trials and Development Unit or ATDU at the Armour Centre at Bovington in Dorset. Accordingly, it is continually modified with the latest improvements such as the loader's Remote Weapon Station as shown here and the Mobile Camouflage System to reduce the tank's visual and thermal image. Following experiences in Iraq with Improvised Explosive Devices, the tank is fitted with an extensive suite of Electronic Counter Measures. The combined armour array is known as Dorchester Level 2F with bar armour protecting the rear hull and turret against infantry-held RPG weapons. In this configuration the tank is designated CR2 TES or Theatre Entry Standard, with these photographs showing CR2 TES as of February 2010 by when British combat troops had withdrawn from Iraq.



Challenger 2 is fitted with six double roadwheels each side, mounted on hydrogas suspension arms. Each of the 12 roadwheel stations is independently sprung and gives 450mm of wheel travel that results in an exceptionally smooth ride. This provides greater comfort to the crew and a more stable gun platform when firing on the move. Of particular note on Challenger 2 is the facility for the driver to adjust the tension of both tracks from inside his compartment through the use of the Hydraulic Track Tensioner (HTT) at the front of the hull, hitherto often a muddy and onerous manual chore for tank crews using outsize spanners. By ensuring that the tracks are always at the correct tension, cross-country performance and vehicle stability are greatly improved whilst trackwear and crew maintenance tasks are reduced. This well-camouflaged Challenger 2 belongs to B Squadron, The Royal Scots Dragoon Guards during Exercise Ulan Eagle in Poland, October 1999.

batch. These crews took part in the handover of the tank to the Fielding Team, assisted in all of the inspections, performed the Batch Test under Armoured Trials and Development Unit (ATDU) supervision and accompanied the tanks during their delivery to their regiments in Germany and the UK.

Every one of the tanks in each batch of 38 was subjected to an inspection that covered every aspect of the tank in the most exacting detail. Every fault from a software glitch in the fire-control system through inaccuracies in vehicle configuration documentation to paint overspray on a grease nipple was recorded. Every tank was tested on a road run to and from the Lulworth gunnery ranges where the ordnance was commissioned and the gun and sighting system 'zeroed' for accuracy. In excess of 22,000 'incidents' were identified on the total of 386 Challenger 2 MBTs and 22 DTTs. A panel of experts scrutinized all of these incidents and applied corrections where needed, as agreed between the Fielding Team and the VDS on-site team. Additionally, out of each batch of 38 tanks, four were chosen and sent to ATDU for a Reliability Batch Test that put those particular tanks through a rigorous three battlefield days' trial. The fate of the whole batch of 38, acceptance or rejection, hung on the results of the Batch Test. The result was that no armoured regiment received a single tank that had a major fault. Any remaining minor faults, and these were extremely rare, were identified to the receiving regiment by the Fielding Team prior to the tank's delivery and fixed by VDS field representatives, usually as soon as the parts arrived within one or two days of the tank's arrival.

The first eight Challenger 2 MBTs were delivered to the Royal Scots Dragoon Guards at Fallingbostel in Germany in late January 1998. The last of the regiment's 38 new tanks was handed over in a ceremony on 30 June 1998, witnessed by some of the leading luminaries in the Challenger 2 story, including the Master General of the Ordnance, Lieutenant General Sir Robert Hayman-Joyce, who had been a keen and consistent advocate of Challenger 2. The final and most difficult hurdle in the Challenger 2 programme acceptance procedure was the In-Service Reliability Demonstration (ISRD). This was conducted by B Squadron, The Royal Scots Dragoon Guards, between August and December 1998 when 12 Challenger 2 MBTs were tested at ATDU in Bovington and at the Gunnery School in Lulworth. The

TOP Rejoicing in the name of CRACK HEAD, Challenger 2 DP73AA of The Royal Dragoon Guards roars over the prairie during Exercise Medicine Man 2 at BATUS on 5 June 2004. The vehicle zap number indicates that this tank is part of the second armoured squadron

LEFT Besides the three regular armoured regiments of the Royal Armoured Corps equipped with Challenger 2, the Royal Wessex Yeomanry provides reservists for Challenger 2 crewmen as circumstances demand. Here, RWxY crews undertake gunnery training at the Castlemartin ranges on 18 November 2013. Above the turret is the telemetry post that records each and every tank engagement during practice firing.

trials involved the tanks covering 5,040km (3,132 miles) during 84 battlefield days while firing 2,850 rounds of 120mm ammunition and 84,000 rounds of 7.62mm ammunition. The final result of ISRD was an unqualified success with all the targets for performance and reliability exceeded conclusively.

The second armoured regiment to be equipped with Challenger 2 was 2 RTR during late 1998 and early 1999. The last of the 386 Challenger 2 MBTs was presented to the British Army on 17 April 2002 at a ceremony held on Salisbury Plain. Fittingly, the tank was delivered to A Squadron, 1 RTR, that can trace its lineage to the very first unit to take the tank to war on 15 September 1916 – A Company, Heavy Machine Gun Corps, subsequently A Company of the Tank Corps, and so forth to this day. For the first time ever, the British Army received a reliability-proven MBT that was ready to go to war as soon as it arrived on the tank park of an armoured regiment – and war was not long in coming.

CHALLENGER 2 TECHNICAL DESCRIPTION

GENERAL

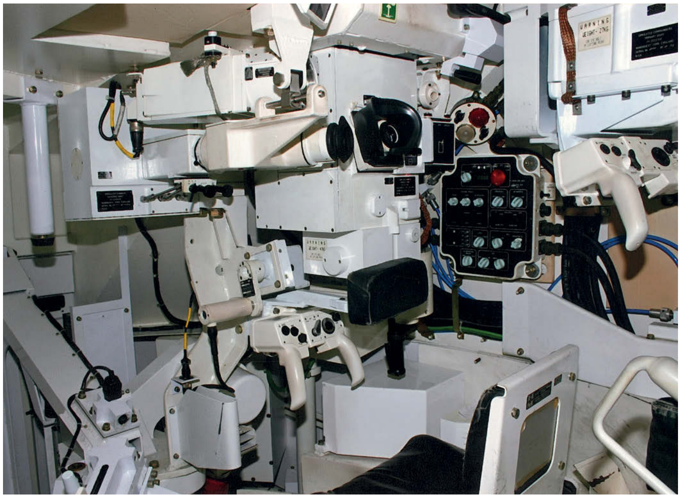
Given the unhappy experiences of most British tank designs during World War II, the British Army decreed that tank crews would no longer enter battle with tanks of inferior firepower or protection to those of their enemies. These two elements became paramount within the three immutables of any tank design – firepower, protection and mobility. Since 1945, Centurion, Chieftain and Challenger have all exhibited a powerful main armament and heavy armour. The Challenger 2 is no exception. It carries a crew of four and has a combat weight of 62.5 tonnes. It has a maximum road speed of 56km/h (35mph) and a range of 250km (155 miles) cross-country and 450km (280 miles) on the road. The tank accommodates the commander, gunner, driver and the loader, for increased fightability and effective round-the-clock operations, which is strongly influenced by the number of crew carried. The British Army remains unconvinced by the concept of a three-man crew and ammunition autoloader. The commander's station is on the right to the rear and is equipped with eight periscopes of magnification 1x providing 360-degree vision. Pushing a red command button under each periscope causes the turret to slew round to align with the periscope. The gunner is seated in front of and below the commander and the loader is to the left of the main armament. The loader's station is equipped with a periscope in the turret roof. The driver's compartment is at the front of the tank.

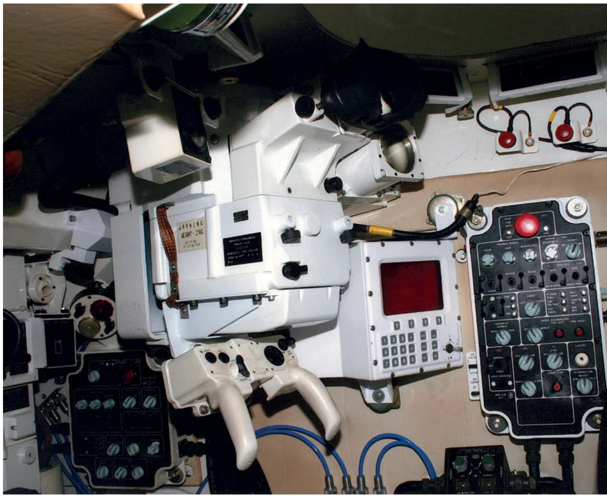
FIREPOWER

Challenger 2 is equipped with an L30A1 120mm rifled tank gun from the Royal Ordnance division of British Aerospace Defence Ltd built at ROF Nottingham. The L30 construction incorporates a chromium lining which provides a harder and smoother internal surface. The chromium lining gives increased velocity and therefore penetration power to the round, greater precision and reduced wear on the barrel. The gun is made from electro-slag refined steel (ESR) and is insulated with a thermal sleeve. The gun is fitted with fume extraction to remove the gases from the barrel. The turret is capable of 360-degree rotation and the weapon elevation range is from minus 10 to plus 20 degrees.

BELOW The gunner's position of Challenger 2.

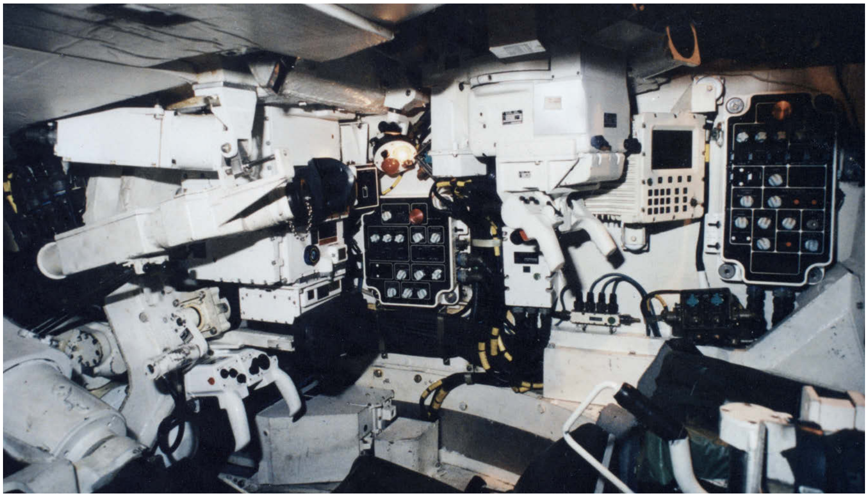
BELOW RIGHT The commander's position of Challenger 2.

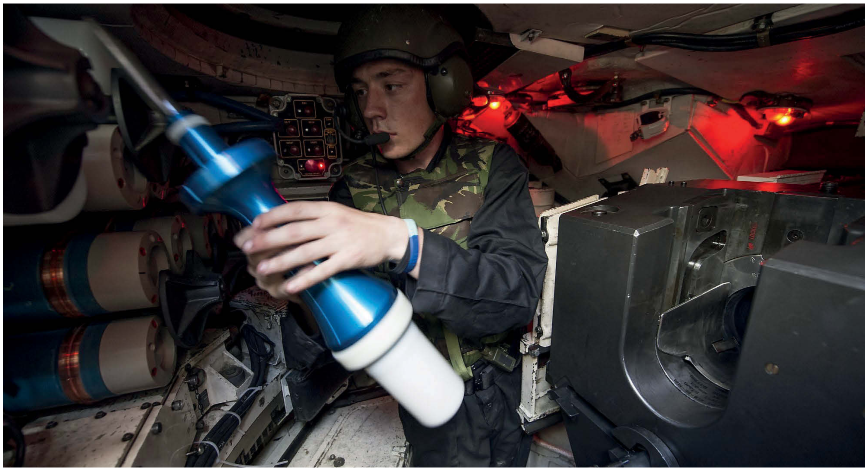




The 120mm L30 gun fires all current 120mm ammunition. There is capacity for 50 projectiles, which can be a mix of APFSDS, HESH or smoke rounds. The L30 gun can also fire the L27A1 depleted uranium round with the L17A1 stick charge propellant. DU has a density approximately two and a half times higher than that of steel and the mass of the DU projectile provides high penetration characteristics. The ammunition, being of the separate projectile and charge loading type, allows the explosive ammunition to be stowed below the turret ring. Armoured bins provide the stowage for the charges.

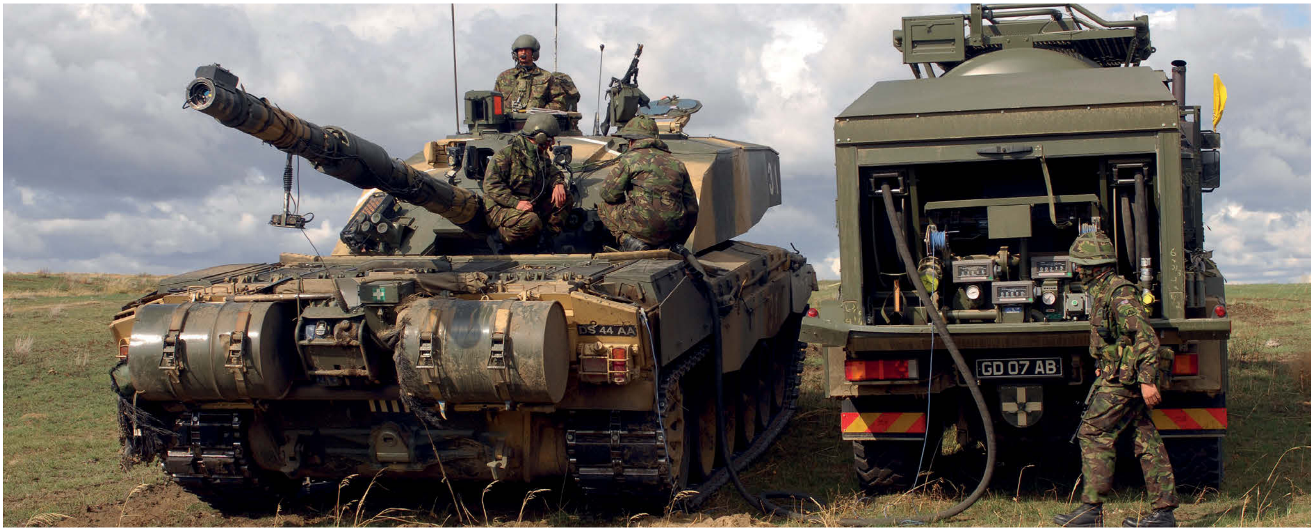
The Challenger 2 is equipped with a Military Standard 1553 data bus that interfaces the Gunner's Primary Sight and the thermal imaging system to the fire-control computer. The latter is a digital computer from Computing Devices Company of Ontario, Canada. The digital CDC computer has capacity for additional systems, for example a Battlefield Information Control System, and navigation and training systems. The gun control is provided by an all-electric gun control and stabilization system from GEC Marconi Radar and Defence Systems of Leicester. The Challenger 2 is also equipped with a McDonnell Douglas L94A1 7.62mm chain gun, which is located coaxially to the left of the main aramament. The loader is on the left-hand side of the main armament and has an L37A2 7.62mm GPMG machine gun on a





ABOVE LEFT The gunner's and commander's positions of a Challenger 2.

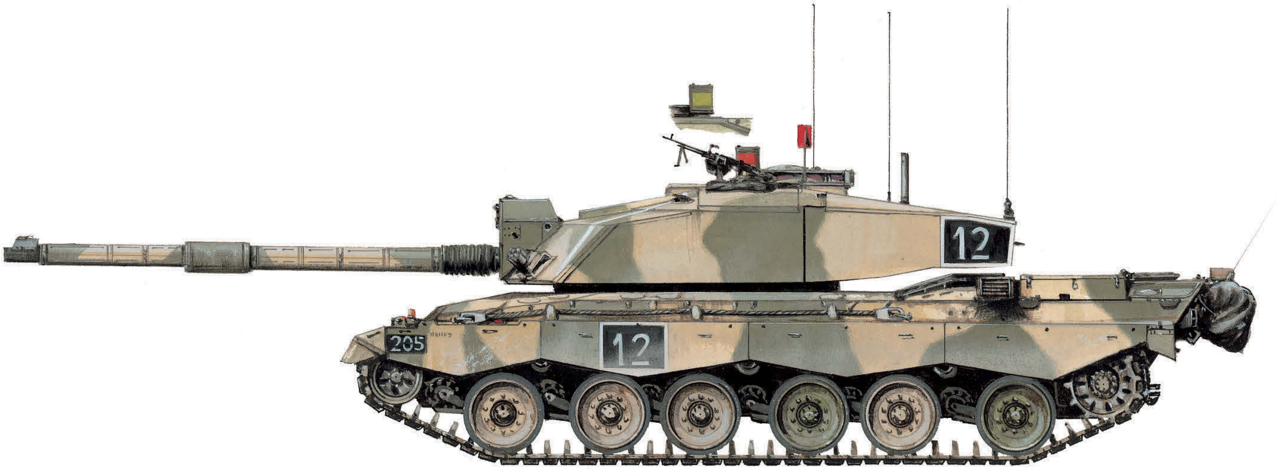
LEFT The only rounds stowed above the level of the turret ring are non-explosive armour piercing projectiles such this Discarding Sabot Trainer round being loaded during a firing exercise in a Challenger 2 of Royal Tank Regiment at Castlemartin in South Wales in June 2014.



Diesel and dust – two of the defining aspects of life in tanks. Fuel is the lifeblood of armoured warfare and a constant supply is vital, together with ammunition, spare parts and finally food for the tank crews. Manoeuvre warfare is only feasible with the essential maintenance of AFVs by REME craftsmen; the combat support of Royal Engineers and the unceasing provision of supplies by the Royal Logistic Corps, notwithstanding the application of firepower by the Royal Artillery and Royal Air Force. Here, a Rheinmetall MAN HX 6X6 Unit Support Tanker provides diesel fuel for a Challenger 2 during an exercise at BATUS in Canada. The extra fuel drums on the rear hull plate of Challenger 2 provide an increase in range on approach marches of approximately 150km.

Helio mount to the front of his turret hatches. Similarly, the commander has an L37A2 7.62mm GPMG machine gun on his cupola.

The target engagement sequence has been designed for simplicity of operation in battlefield conditions. The same engagement sequence is followed for static and moving targets in daylight or by night. The gunner or the commander aligns an aiming mark on the target, presses the laser rangefinder button and then presses the fire button. The commander has a gyrostabilized sight, model VS 580-10, from SAGEM, formerly SFIM Industries of France. The upper unit of the VS 580, containing the gyrostabilized panoramic sight and electronics, is mounted on the



CHALLENGER 2, THE QUEEN'S ROYAL HUSSARS BATTLEGROUP, EXERCISE MEDICINE MAN 1, BATUS, CANADA, MAY 2003

This Challenger 2 is painted in the green and yellow camouflage scheme characteristic of the vehicles of the British Army Training Unit Suffield, BATUS, in Canada. Highly realistic live-firing exercises are conducted there, and safety is a prime consideration. To this end there are white stripes on the turret roof known as the '45s' that are visible through the commander's and gunner's sight and serve to indicate the safe arcs of fire when using live ammunition. Similarly, the Commander's Primary Sight has red and green patches on each side so that range safety staff know at all times exactly in which direction the CPS is facing. Behind the commander's cupola is another safety feature – a red metal device indicating that the tank's weapon systems are loaded with live ammunition and ready to fire. On the turret sides and rear are the vehicle callsign, One Two. This is also painted on the side skirts as is the vehicle 'zap code'. The VRN is DP73AA.

turret roof. A Neodymium-YAG laser rangefinder is incorporated into an intermediate assembly which joins the upper unit to a lower telescope assembly inside the turret. The telescope assembly houses the optical viewing system, hand controls, electronics and the sight stabilization system. The sight provides all round vision without the commander having to move his head. The elevation range is plus or minus 35 degrees. The field of view with 3.2x magnification optics is 16.5 degrees, and with 10.5x magnification optics, the field of view is 5 degrees.

A thermal imager, the Thermal Observation and Gunnery Sight II, TOGS II, from Pilkington Optronics of Glasgow provides night vision. The sensor is the UK TICM 2 thermal imager. The imager is mounted inside an armoured barbette above the gun. An on-board compressor and gas bottle pack provide cooling for the imager. Symbols are overlaid on the thermal image to show the aiming marks and system status data. The thermal image, with magnification 4x and 11.5x, is displayed in the gunner's and commander's sights. The thermal image is also displayed on relaxed-viewing monitors in the commander's and gunner's stations.

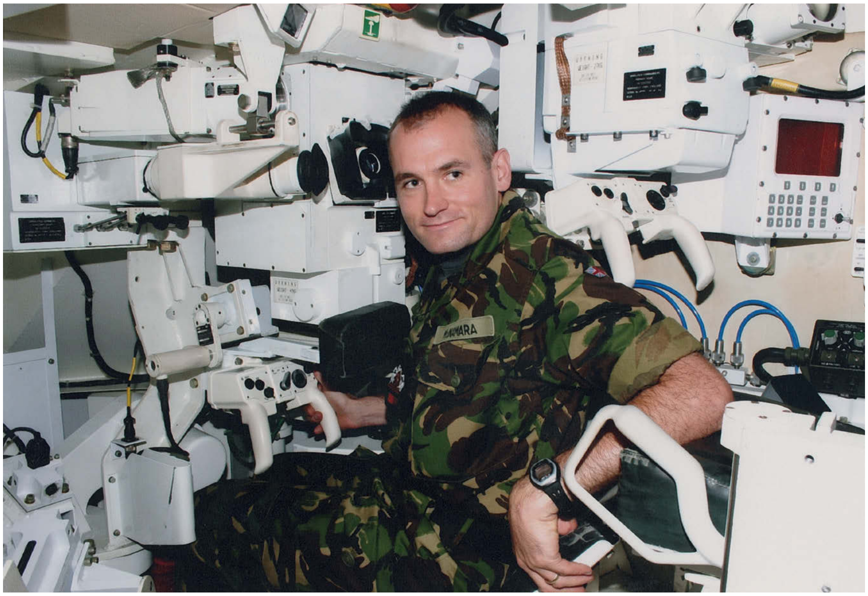
The gunner has a stabilised Gunner's Primary Sight, GPS, from Pilkington Optronics. The sight consists of a sight body with a visual sighting channel, a head unit with a stabilized aiming mirror, a 4Hz Neodymium-YAG laser rangefinder and a display monitor with a monocular eyepiece. The laser rangefinder with wavelength 1.064 microns, operates over the range 200m to 10km. The range accuracy is plus or minus 5m and the discrimination is 30m. The gunner is also equipped with a reversionary mode telescope, model L30, from BAE/Equipment York, mounted coaxially with the main gun. The driver is equipped with a Passive Driving Periscope from Pilkington Optronics for night driving by means of a night vision image intensifier device.

OPPOSITE The firepower of Challenger 2 is formidable, as was shown to telling effect during Operation Cray held on 16 September 1992. This was a demonstration of new equipments of the British Army to foreign military observers. Challenger 2 62KK25 engaged and hit six separate targets in 26 seconds. Challenger 2 uses three-part ammunition with all explosive elements stowed below the level of the turret ring for greater survivability. Here, the tank commander, Corporal Colin MacIntyre, guides his Challenger 2 into position at the start of the demonstration as the loader, Lance Corporal Sam Boyd, scans to the rear.

ENGAGEMENT PROCEDURE

The commander aligns the roof-mounted panoramic sight on a target and presses the align switch to slew the turret round until the gun is automatically positioned on the target. The gunner then takes over the engagement of the target, and presses the laser rangefinder and the fire buttons to fire the gun. As soon as the gunner has taken over the engagement of the target, the tank commander is able to locate and take range measurement of a second target using the commander's sight. The data for both targets, the first target being engaged by the gunner and the second target, are stored in the digital fire control computer. When the gun has been fired and the kill assessment on the first target completed, the commander presses the align switch which results in the turret slewing round to align the gun on the second target and automatically firing the gun. The operational procedure greatly enhances the firepower of the tank, in that the Challenger can effectively engage multiple targets in rapid succession.

Unfortunately, the system is limited to a degree as the Commander's Primary Sight can only operate in daylight as it has no thermal imaging capability due to costs constraints. At night or in poor visibility, the commander can only use the same thermal imaging as the gunner by means of the TISH mounted above the main armament. A thermal engagement is not difficult but requires concerted and repeated training on gunnery simulators to master the laying of the 'aiming mark'. During static-to-static engagements this is straightforward but becomes more difficult when the target is moving and even more so when the Challenger 2 and the target are both moving, as is only to be expected. Thus it requires significant skill and application to align the 'floating aiming mark' with the target complemented by the computer software with what is known as 'aided lay'. Suffice to say this is a gross oversimplification of a highly complex process. Challenger 2 is also equipped with various revisionary modes of engagement in what is known as 'graceful degradation'. As systems fail, the Fire Control Computer identifies the most appropriate remaining mode and informs the crew via their viewing monitors with the final revisionary mode being the gunner's L30 coaxial telescope with an etched graticule.



As part of the Challenger 2 procurement programme a whole range of training simulators has been developed. These include the computer-based trainer, loader drills trainer and the sophisticated precision gunnery training equipment (PGTE) comprising the part task trainer and the turret gunnery trainer as shown here. This replicates the gunner's and commander's positions incorporating all the sighting systems, controls, switches and indicators to enable the crewmen to undertake all types of engagements in five different virtual-reality scenarios of Central Europe, Canadian prairie, urban area, desert and a tank gunnery range, each covering up to 100km^2. The computer-generated imagery and training programmes are so realistic that it is not uncommon for a newly fledged gunner to achieve a first-round hit on the move at 1,500m firing HESH on his very first battle run in a Challenger 2.

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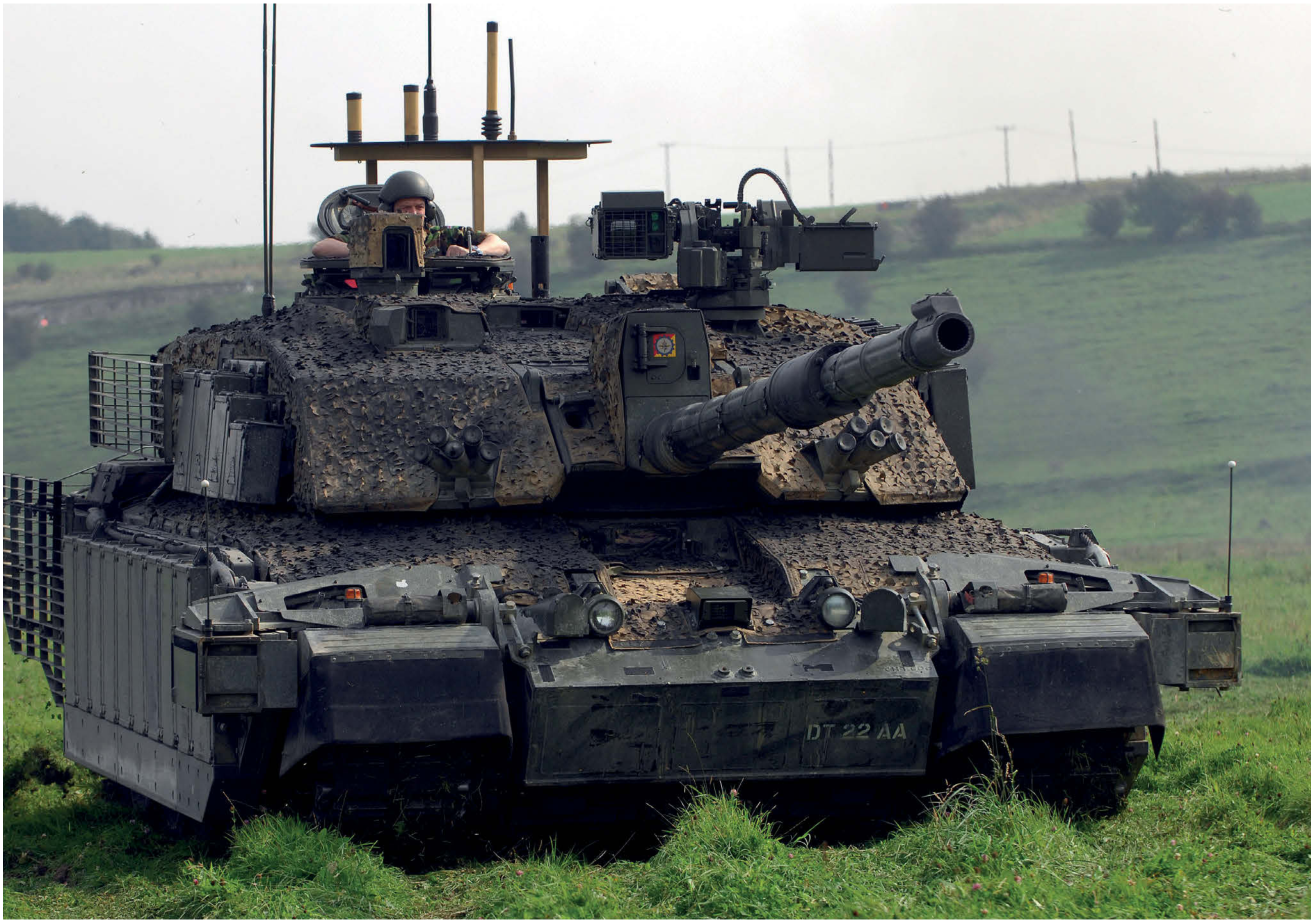
A troop of Challenger 2 tanks of C Squadron The King's Royal Hussars fire live ammunition during Exercise Prairie Lightning in support of the Royal Welsh Battle Group at BATUS in June 2014.

PROTECTION

Given the emphasis British tank designers give to armour protection, Challenger 2 incorporates the very latest form of Chobham armour that is now designated Dorchester after the county town near to Bovington – the home of British armour. Originally the revolutionary composite armour was known as Burlington but since this is the name of a company renowned for the manufacture of ceramics, the name was soon changed to mask the fact that ceramic was a key constituent of the new armour array. Accordingly, it became known as Chobham armour after the location of the Military Vehicles and Engineering Establishment at Chobham in Surrey, England. Once its development was announced to the public in 1970, Chobham has become the generic name for all composite armours among the NATO alliance.

The configuration of Dorchester armour depends on the level of threat likely to be found on a given battlefield. On a basic Challenger 2 it is known as Dorchester Level 1 or DL1 as found on the tank in everyday training. In any operational scenario, Challenger 2 is fitted with OAP or Operational Armour Packs in the three-letter acronyms beloved of the military. These comprise additional Dorchester armour packs along the turret and hull sides and Explosive Reactive Armour (ERA) arrays on the glacis plate and hull front as well as additional belly armour. With OAP, the configuration is known as Dorchester Level 2 with a letter suffix to denote the particular combination. In urban warfare or a situation where there is a high likelihood of multiple infantry anti-tank weapons, bar armour is added around the engine compartment and rear hull.

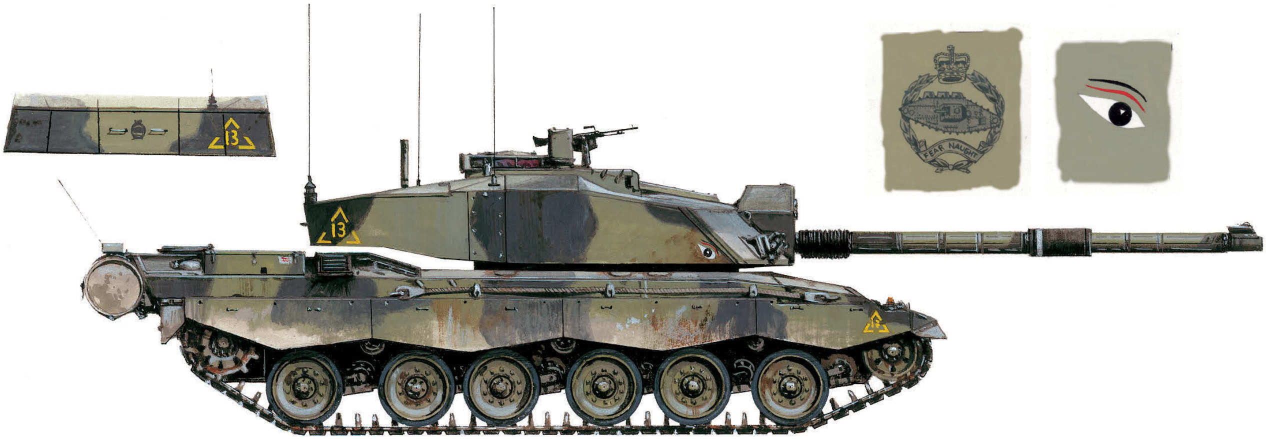


On display at the Urgent Operational Requirement or UOR demonstration on Salisbury Plain in September 2008 was this Challenger 2 in Theatre Entry Standard or TES. This denotes the very latest modifications that have been fitted to the MBT to counter new threats on the battlefield such as those encountered in the Basra region of Southern Iraq. UORs applied to all manner of British Army equipment from sniper rifles to the Mastiff PPV Protected Patrol Vehicle for the campaigns in Iraq and Afghanistan.

For increased crew safety, the movement of the turret and gun is achieved by a solid-state electric drive rather than by high-pressure hydraulic drive. The electric drive removes the risk associated with rupturing of high-pressure hydraulic hoses in the crew compartment. As is customary with British tanks, the stowage of explosive charges is below the turret ring, which provides a less vulnerable position than in the turret bustle. The latter contains the NBC filtration system that protects the crew from harmful agents by overpressure. In addition, crew comfort is enhanced by the Crew Temperature Control System that manages the ambient temperature inside the vehicle. It also acts to alleviate the heat generated by all the on-board electronic systems: a virtually impossible task in the height of an Iraqi or Omani summer with temperatures of 50-plus degrees Celsius. On each side of the front of the turret is an L8 smoke grenade discharger, from the Helio Mirror Company of Kent, each of which projects five grenades to produce an instant smoke screen. The Challenger 2 can also create a continuous smoke screen by the injection of diesel fuel into the engine exhausts.

MOBILITY

The hull and automotive parts of the Challenger 2 are based upon its predecessor Challenger 1, but Challenger 2 incorporates over 156 improvements aimed at increasing reliability and maintainability. To list all these would be onerous but



CHALLENGER 2, A SQUADRON, 1ST ROYAL TANK REGIMENT, EXERCISE AURORA, SOUTH CAROLINA, USA, 3 JULY 2004

At 0745hrs on 3 July 2004, the United States of America was 'invaded' by foreign tanks when Challenger 2 MBTs of 1st Troop, A Squadron, 1 RTR, waded ashore from LCUs (Landing Craft Utility) of HMS *Albion* on to Onslow Beach at Camp Lejeune, the home of the US Marine Corps. The four Challenger 2 MBTs of A Squadron, 1 RTR, were acting as tank support to 42 Commando, Royal Marines, during Exercise Aurora, a joint exercise involving troops from Britain, France, Holland and the USA. The four tanks belonged to The Queen's Royal Lancers and were repainted in Royal Tank Regiment markings for Exercise Aurora. As a composite troop, it had four tanks with the fourth one under the command of Sergeant 'Frog' Weeks having the callsign One Three. This is displayed within the triangle of A Squadron and is painted in yellow on the turret sides and rear as well as the forward side skirts. Centrally on the turret rear to the left of the callsign is a large decal bearing the Fear Naught crest of the Royal Tank Regiment. At the forward bottom edge of the turret sides is the Chinese Eye insignia of 1 RTR, acquired following its amalgamation with 4th Royal Tank Regiment that traces the symbol back to World War I. Around the fume extractor is a single white band indicating 1st Troop. The VRN is DR88AA.

suffice to say there are 37 improvements in vehicle electrics; 33 to main engine and GUE; 11 to gearbox assembly; 11 to running gear and suspension and several improvements to the hull and fittings. Among the latter, the most appreciated by the crew is the facility to open the engine decks single-handedly by means of a torsion bar counterbalance, whereas on Challenger 1 it was necessary to employ a crane to lift off the engine decks. A characteristic of Challenger 2 is the fitting of racks on the rear hull to carry two 45-gallon fuel drums to increase road range during approach marches. These are provided with a quick release mechanism to jettison the drums before battle is joined. An electric pump is provided to transfer diesel to the main fuel tanks or to another vehicle.

The Challenger 2 is powered by a 12-cylinder 1,200bhp diesel engine, from Perkins Engines (Shewsbury) Ltd of Shropshire and a David Brown TN54 epicyclic transmission with six forward and two reverse gears. The hydrogas suspension with its maximum wheel travel of 450mm provides both a comfortable ride to the crew and a stable gun platform. The tracks are of the double-pin type and are manufactured by William Cook Defence Ltd. One of the novel features of Challenger 2 is the fitting of hydraulic track tensioners for the front idler wheels that allows the driver to adjust track tension to the optimum setting from his position under armour, thereby reducing wear and tear as well as relieving the crew of an onerous 'track bashing' task. All Challenger 2 hulls have attachment points to accept the Pearson Engineering Universal Dozer Blade, latterly BEMA (the Bulldozer Earth Moving Attachment), or a Track Width Mine Plough.

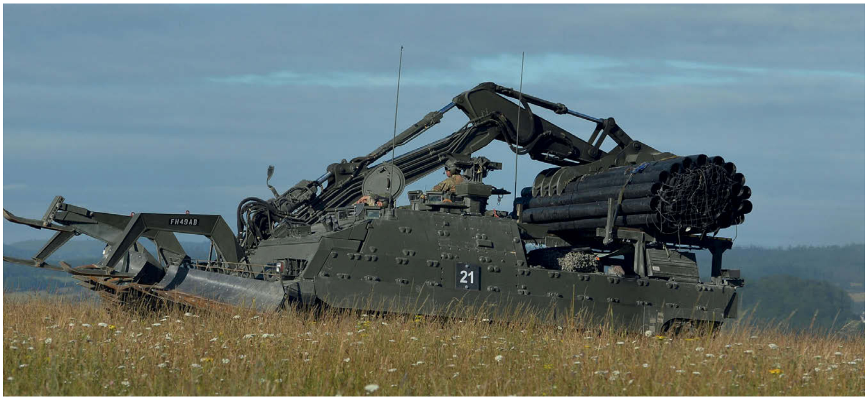
Despite a combat weight of 65 tonnes, Challenger 2 has admirable battlefield agility. It is powered by a Perkins Engines Company 12-cylinder turbocharged CV12 TCA Model 3 Mark 6A diesel engine developing 1,200 bhp at 2,300rpm coupled to a David Brown Defence Equipment Ltd transmission that can be readily replaced in the field as a complete powerpack using the hydraulic crane of a CRARRV.

CHALLENGER 2 SPECIAL PURPOSE VARIANTS

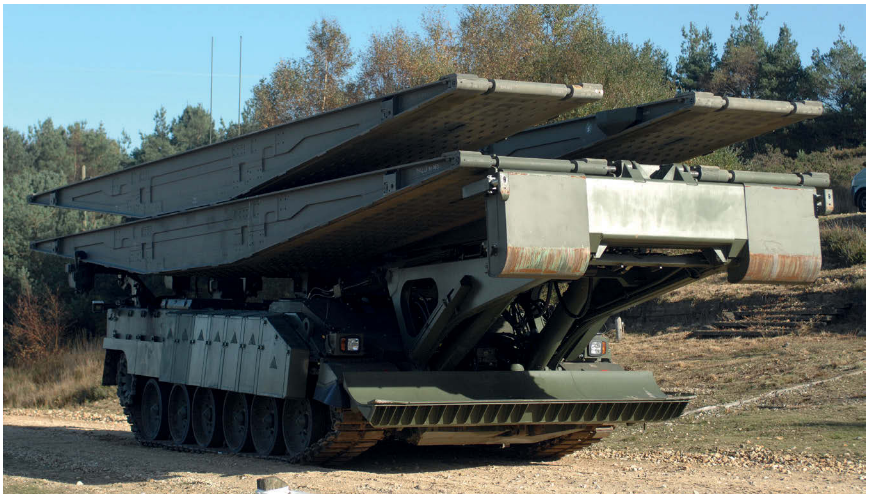
TROJAN AVRE

With the introduction of Challenger 2, the armoured engineer special purpose variants based on Chieftain lacked the speed and power to support the new MBT on the battlefield. Accordingly, the British Army issued a requirement for 102 vehicles in a programme known as Future Engineer Tank to include an Armoured Vehicle Launched Bridge (AVLB) designated Titan and an Armoured Vehicle Royal Engineers (AVRE) Trojan to be based on the Challenger 2 chassis. A contract was placed in 2001 for 33 models of each type and the first vehicles were delivered in 2004. Both Titan and Trojan entered service with the Royal Engineers in 2006. Trojan AVRE is an armoured engineer vehicle designed to clear and create battlefield obstacles. Trojan provides the capability to enable mobility and counter-mobility Close Support (CS) to armoured and mechanized formations in the direct fire zone, across the full spectrum of conflict. To carry out these tasks, Trojan can be fitted with Front End Equipment (FEE) including BEMA and FWMP (Full Width Mine Plough). As its name implies, BEMA allows the crew to undertake various earth-moving tasks including the preparation of hull-down tank scrapes; uprooting antitank obstacles; developing river or ditch crossing sites for laying fascines or Titan AVLB. The FWMP produces a safe lane through a minefield and is often used in conjunction with Python. The latter is an explosive line charge that is propelled across a minefield by a rocket motor and when detonated clears a track some 8m wide and 200m long. It is standard practice for the Trojan to follow up with the FWMP to push aside blast-proof mines and those disrupted by the explosion. The cleared mine breach can then be marked from under armour using the on-board Obstacle Marking System that implants illuminated indicator flags at its edges.

Of particular note, Trojan incorporates a highly effective excavator bucket for digging and earth-moving tasks that doubles as a lifting arm to lay fascines and

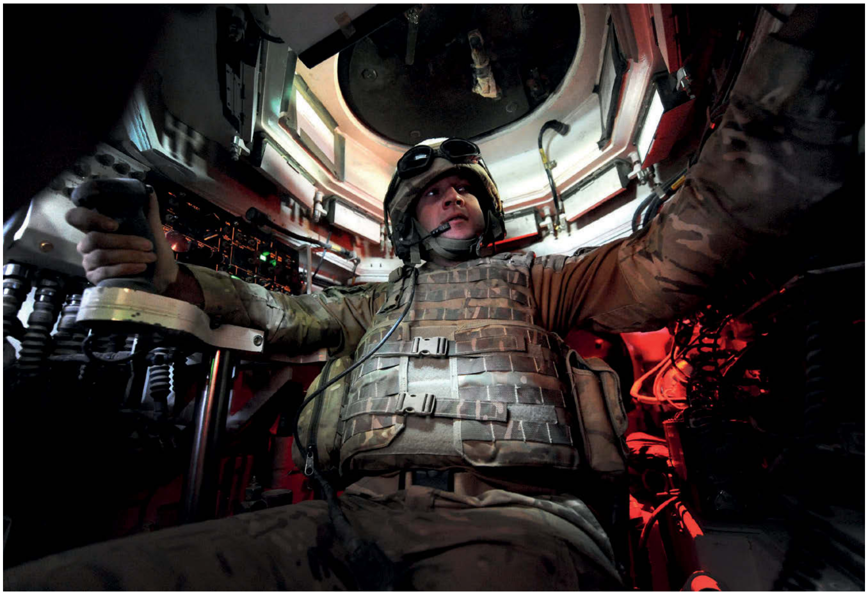


TOP LEFT For the first time in the history of the armoured engineers, the British Army currently has all its major AFV variants based on a common chassis with Challenger 2 MBT, CRARRV, Titan AVLB and Trojan Armoured Vehicle Royal Engineers or AVRE. As it name implies the AVRE is employed by the Sappers to undertake numerous roles on the battlefield, particularly mine clearing and obstacle crossing. This Trojan AVRE is undertaking Exercise Lion Strike on Salisbury Plain Training Area in July 2014.



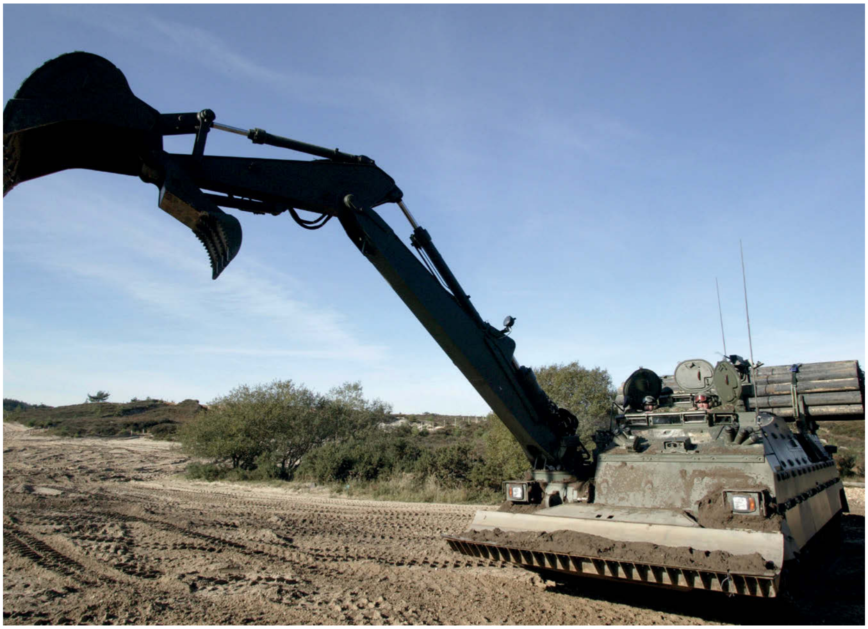
LEFT Both Titan and Trojan are fitted with the latest version of the Challenger 2 powerpack incorporating the CV 12 TCA No. 3 Mk 8A engine and TN54E transmission that provide increased durability, improved low-speed performance and reduced fuel consumption.

A Sapper of 5 Armoured Engineer Squadron of 23 Engineer Regiment drives his Trojan AVRE during Operation Hamkari in support of the 2nd Battalion of the US Army 502nd Regiment in Kandahar Province on 2 November 2010.

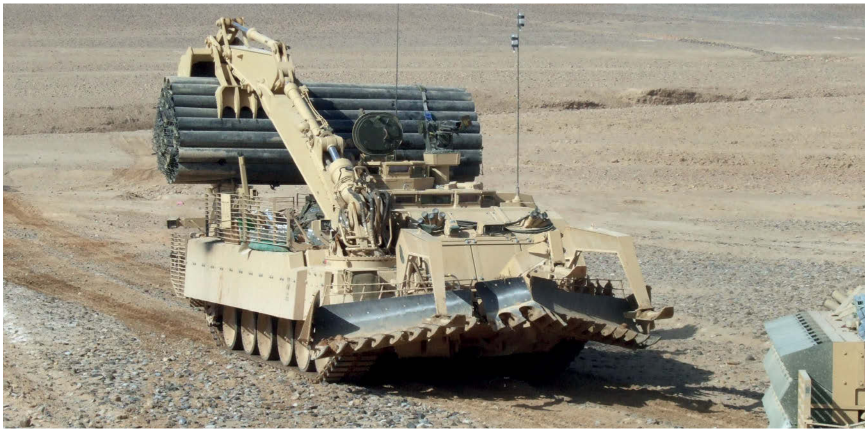


The commander of a Trojan AVRE controls the hydraulic Caterpillar Model 319 excavator bucket during a Royal Engineer task. Trojan is equipped with numerous vision devices and external cameras to allow enhanced situational awareness and precise placements of equipment or digging procedures.

acts as a multipurpose crane. The latter has a lift capability of 5.5 tonnes and the bucket a capacity of one cubic metre. A Midi Fascine can be carried on the back of the vehicle above the engine decks and emplaced using the excavator. Pipe fascines are simple devices to fill anti-tank ditches and wet or dry gaps too narrow to justify bridging. Trojan commonly tows an AVRE Trailer carrying a variety of engineer stores such as a single fascine; two Class 70 trackrolls; one BEMA; one FWMP or eight standard NATO pallets. The AVRE can also tow the L9 four-wheeled trailer equipped with the Python minefield clearing system. All in all, Trojan is a highly versatile Combat Engineer Vehicle particularly when employed in conjunction with Titan.



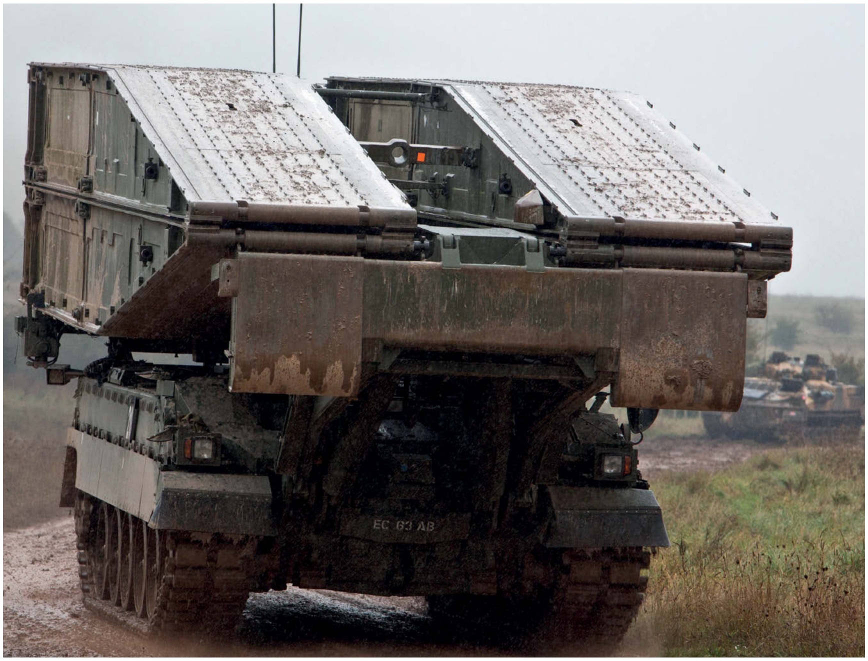
Besides its dozer blade, Trojan incorporates a hydraulically operated Caterpillar Model 319 excavator bucket that is used for clearing obstacles as well as for digging. For self-defence, the three-man crew has a remotely controlled weapon station with all-round traverse and an integral thermal imaging observation device. There are numerous other cameras, or indirect viewing systems, for the crew to monitor every aspect of vehicle operation on their individual display units when working ‘closed down’ under armour. A ‘midi-pipe’ fascine can also be carried over the rear decks to fill water-filled anti-tank ditches or streams. The fascine is deployed and retrieved by the excavator arm.



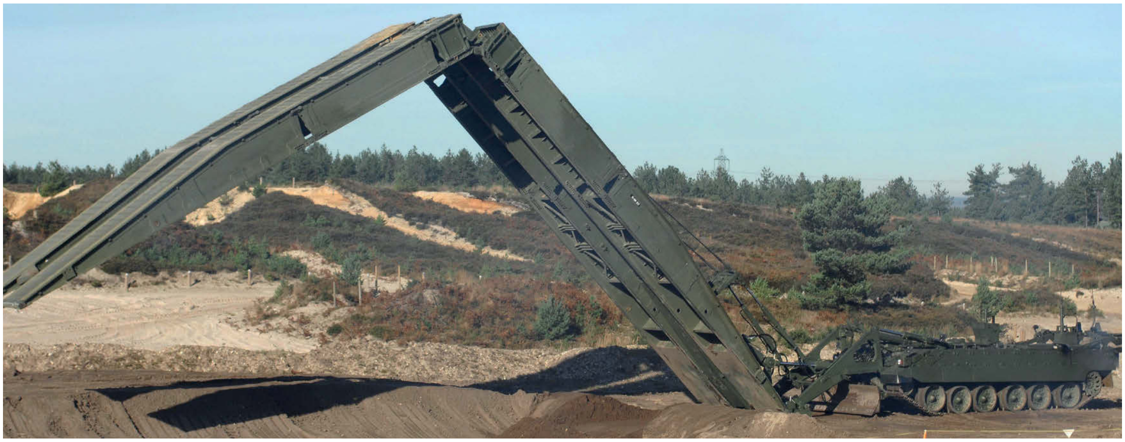
During Operation Herrick, it was common practice for logistic convoys to be headed by a Trojan AVRE to disrupt IEDs by a combination of mine plough, electronic counter measures and Python Minefield Breaching System. The latter was first used in anger on 15 February 2010 near Patrol Base Wahid during Operation Moshtarak to clear a path through a dense belt of Taliban IEDs rather than clearing mines painstakingly by hand.

TITAN ARMOURED VEHICLE-LAUNCHED BRIDGE (AVLB)

Titan AVLB is an armoured engineer vehicle designed to bridge both wet and dry gaps. It can carry and launch a series of bridges with MLC 70, including the 26m (85ft) No.10 Tank Bridge in two minutes as well as the No.11 to span gaps of 14.5m (48ft) and the No.12 for shorter gaps of 12m (39ft) in just 90 seconds. By using supplementary trestles and wedges, Titan can lay multiple combination bridges in depths of 5m (16ft) and width of 60m (197ft), as well as overbridging oil pipelines and under-stressed bridges. All bridges can be recovered from either end although this process invariably takes longer than launching. The success of any bridging operation is always dependent on careful and thorough reconnaissance. Like Trojan, Titan can be fitted with FEE including BEMA and TWMP. It has a crew of three Sappers and a road speed of 59km/h (37mph) when fully laden. Titan entered service with the Royal Engineers in 2008 and 33 were built by Vickers Defence Systems.



Following the development of the Future Engineer Tank project, a contract worth £250 million was awarded to Vickers Defence Systems for the manufacture of 33 Titan Armoured Vehicle Launched Bridge or AVLB and 33 Trojan Armoured Vehicle Royal Engineers or AVRE. These Challenger based vehicles superseded their venerable Chieftain forebears from 2008.



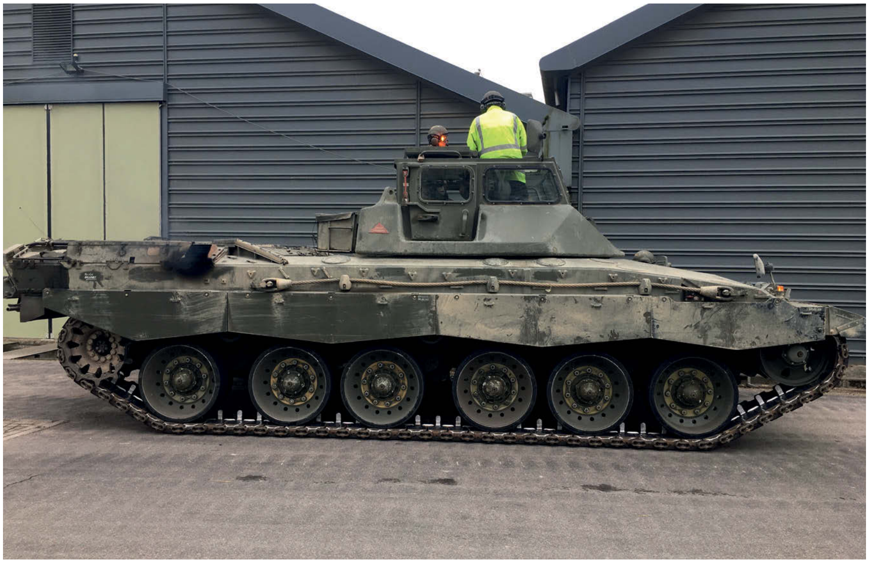
The Challenger 2 bridgelayer is named Titan. With the three-man crew completely protected under armour, Titan can carry and launch the 26m-long No.10 Tank Bridge within two minutes to span gaps up to 24.5m. It can also carry and launch the 13.5m-long No 12 Tank Bridge, as shown here, within 90 seconds. These bridges can be retrieved from either end for maximum tactical flexibility. Like Trojan, Titan can be fitted with the universal dozer kit or track-width mine plough.

DRIVER TRAINING TANK

The British Army was slow to adopt the concept of the dedicated driver-training tank. The first purpose-designed model was the Challenger Training Tank or CTT. For Challenger 2, the Driver Training Tank or DTT was developed with the first prototype produced in September 1993. In all 22 DTTs were manufactured by Vickers Defence Systems with an all-weather cabin in place of the turret. Students and instructors are housed in the cabin to monitor the efforts of the learner driver and correct mistakes accordingly. As a secondary role, the DTT can be fitted with the BEMA dozer blade or mine plough as a supplementary CEV, or else act as a towing vehicle for disabled tanks and AFVs.

OMANI CHALLENGER 2

In June 1993, the Sultanate of Oman placed an order with VDS for Challenger 2 main battle tanks to equip a single armoured regiment. The First Main Battle Tank Regiment (1 MBTR) was chosen to receive the new equipment. At the time 1 MBTR was equipped with 29 Chieftain tanks that had been supplied in the 1980s. The new reformed regiment was to be a Type 43 with three tank squadrons and a headquarters



As part of the Challenger 2 procurement programme 22 Driver Training Tanks or DTT were purchased from VDS. The first DTT was completed by VDS on 10 August 1993. Based on the improved Challenger 2 hull, powerpack and running gear, the vehicle is weighted to the same level as the MBT and the instructor can induce faults in the vehicle to test the aptitude of his students.

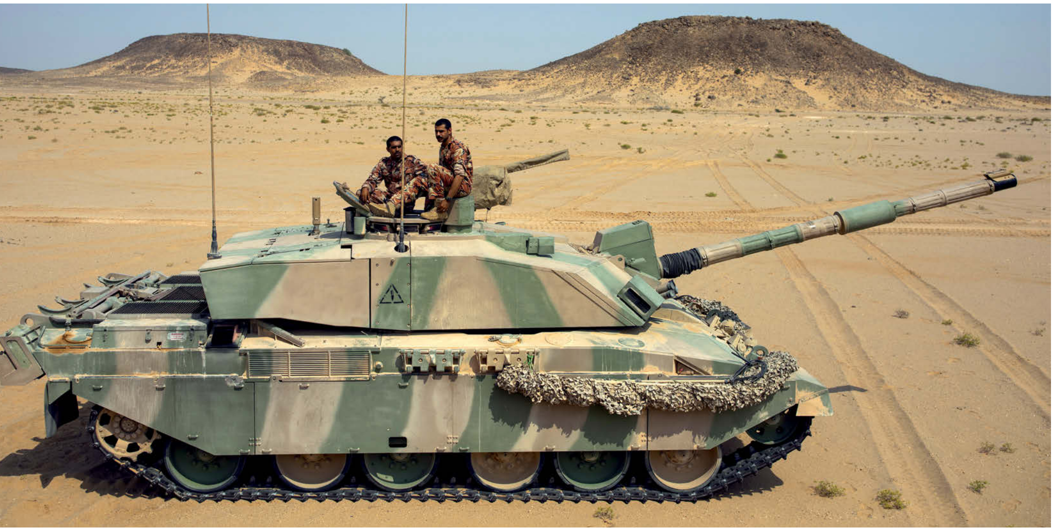
squadron. Each tank squadron was to have 14 tanks and the HQ squadron would have had one for the commanding officer. However, this was not to be, as the order was reduced by five. In early 1995, the 38 Challengers that were delivered formed three squadrons of 12 and two vehicles in Headquarters Squadron. A subsequent order for an additional 20 MBTs was placed in November 1997 with final deliveries in 2000.

A trainee driver beams with delight to be at the controls of a Challenger 2 Driver Training Tank.

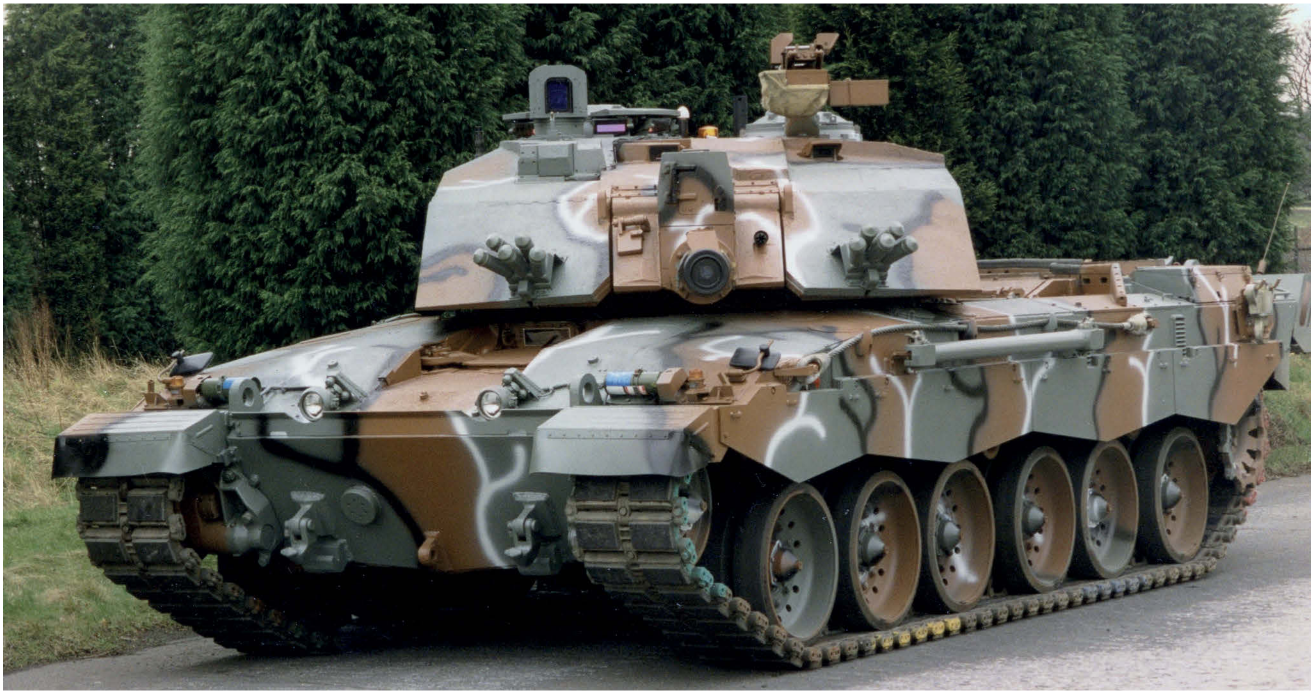
Ordered at the same time were two DTT training tanks and four CRARRVs. The two DTTs were to be used by the Armour School to train drivers and the CRARRVs would be split: two with 1MBTR and two with the Command Workshop. The DTTs and CRARRVs would have the same cooling system, fuel system and tracks as the MBT. Training equipment supplied included three Turret Gunnery Trainers (TGT), six Part Task Trainers (PTT), one Loaders' Drill Trainer (LDT) and a Secondary Armament Drill Trainer (SADT). A full training package was also supplied by VDS which consisted of a full Training Needs Analysis (TNA) and all the courseware that was required to teach all the pilot courses. An additional LDT was supplied during 2008. All training systems, courseware and publications were provided in dual language, Arabic and English.

The intention was that the Omani vehicles would be delivered after all relevant modifications coming out of the UK Reliability Growth Trial (RGT) had been incorporated into the Omani build. However, the UK RGT was delayed and the Omani vehicles were produced and partly delivered before the UK RGT was concluded. It was subsequently agreed that all the relevant modifications coming from the UK RGT would now be incorporated when the vehicles were delivered to Oman. These modifications, along with other Omani-specific changes, were implemented in Oman by a team from VDS and took several years to complete, ending in 2003.

The differences between the Omani tank and the UK Challenger 2 were largely dictated by the high ambient temperatures experienced in the Sultanate; temperatures exceeding 50 degree Celsius are not uncommon, and the tank is very rarely driven on metalled roads. The Omani soldiers were at first sceptical of the Challenger 2 but



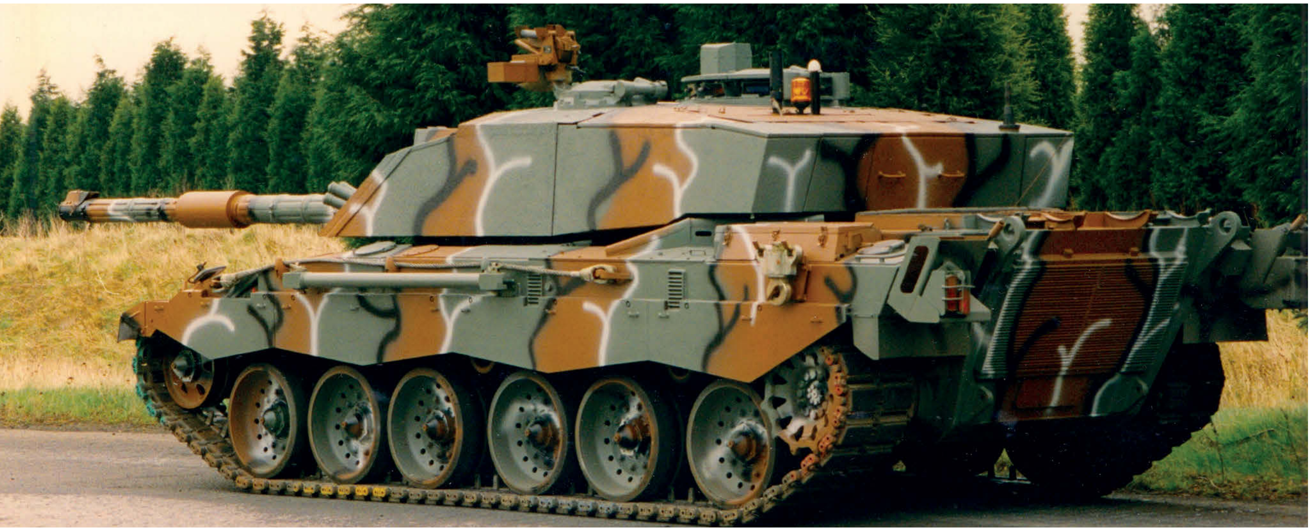
A Challenger 2 of the 1st Royal Omani Tank Regiment prepares for live firing during Exercise Saif Sareea 3 in conjunction with British Armed Forces. The Omani Challenger 2 differs in detail from the British Army version, particularly in the cooling group of the powerpack to allow full engine power even in extreme temperatures of 50 degrees C. (Getty Images)



The Challenger 2E began as Project Exmouth based on prototype V9, 06SP95, but space limitations preclude a full account of this version of the MBT. Suffice to say, it features many enhancements, not least of which is the MTU/Renk 1,500bhp EuroPowerPack and full thermal imaging for both the gunner's and commander's primary sights, that takes Challenger 2E at least half a generation beyond the standard MBT. VDS subsequently purchased the tank from the MOD and it became the export model of Challenger 2 for the company, latterly Alvis Vickers Ltd and then BAE Systems Land Systems. By combining the best elements from around the world with German automotives, French sights, a North American fire-control system and British armour protection, Challenger 2E is a truly formidable MBT.

over the ensuing years they have used the vehicle in a very aggressive and confident way. Most shooting on the ranges is done on the move with very little from a static firing point. Omani drivers seem to be completely fearless when at speed so make the best use of Challenger 2's excellent mobility.

The differences between the UK and Oman vehicles can be outlined as follows. The Omani Challenger 2 embodies the same single-pin track as CRARRV and older Challengers of the British Army. Large full-depth skirting plates and dust mitigation shields are fitted. A larger air conditioning unit is incorporated for greater cooling for the crew and electronic components and is situated in the space of one fuel tank, giving an overall internal fuel capacity of 1,321 litres as against 1,592 in the British Army's tank. The fuel bag tanks were replaced by a sealed compartment system similar to that used in aircraft; this system has subsequently been adopted for the Titan and Trojan engineer vehicles for the British Army. Two additional fuel fillers are provided on each side of the engine decks to enable faster refuelling in the field. The main engine, a Perkins CV12, and the auxiliary GUE, although basically the same as the UK vehicle have better cooling by diverting the airflow through larger radiators, and then through the rear of the vehicle. The main fans are powered by a hydraulic pump driven from a power take-off on the gearbox. The transmission has a larger heat exchanger fitted. The GUE has a high capacity five-bladed fan and a thermal switch to cut off the fuel should the drive to the GUE fan fail. Of course, the main engine cooling will cool the GUE if the main engine is running. The modified airflow reduces the problem of dust being drawn up into the engine and transmission decks when the vehicle is at speed. The loader's machine gun is a Browning .50-calibre on a pintle mount. Ammunition stowage was changed internally to allow for the larger .50-calibre ammunition boxes. Two RACAL Jaguar VRQ 316 secure radios were fitted. More water stowage was required so two jerrycan stowage positions were placed on the turret front. A Garmin GPS satellite navigation system was installed at the commander's station.



The Challenger 2E was offered on the international market on several occasions but without success, including to Greece, Saudi Arabia and South Africa. The latter undertook comparative trials between the 2E and the Leclerc as part of Project Aorta to replace the Olifant tank in service. The Challenger 2E came second in the competition primarily because the MOD would not provide the latest ammunition for the L30 main armament so the South African specifications for armour penetration were not met. In the event, neither tank was chosen. Nevertheless, the camouflage scheme chosen for Project Aorta is spectacular as devised by apprentices at VDS to suit an African successor to Olifant.

The Challenger 2E was developed by Vickers Defence Systems as an export model of Challenger 2. Given that the expected market for such an MBT lay in the Middle East, the tank was specially designed for operations in hot climates. The main improvements over Challenger 2 were the more advanced fire-control system and enhanced mobility. The latter was due to the adoption of the 1,500bhp MTU 883 transverse engine coupled to a Renk HSWL gearbox with five forward and three reverse gears. Known as the EuroPowerPack, it provides 24bhp per tonne up to 55 degrees Celsius with a speed of 72kph (45mph) on roads and 42kph (26mph) cross-country. Not only is this more powerful but it is also more compact, which allows larger fuel tanks and thus greater range – up to 550km (342 miles) on roads and 250km (155 miles) cross-country. Unlike Challenger 2, the 2E has a commander's stabilized panoramic day and thermal night sight incorporating a Nd-Yag laser rangefinder and TI channel while the gunner's TI view is also visible in the sight. The tank also has an integrated Battle Management System with a Tactical Display Unit fully integrated into the fire-control computer and fire-control panel with digital input from GPS. The driver also has a thermal imaging night-vision viewer as well as rearward facing camera for easier reversing. The main armament is the Royal Ordnance L30 120mm rifled tank gun with 50 projectiles in a mix of APFSDS, HESH and Smoke. Coaxial armament is the Hughes 7.62mm chain gun and at the loader's hatches is a .50-calibre Browning area-defence machine gun. Despite several sales demonstrations, the Challenger 2E was not adopted by any nation and Vickers Defence Systems withdrew the 2E from marketing in 1995.

OPERATIONAL DEPLOYMENT OF CHALLENGER 2

Challenger 2 was first deployed operationally in 2000 following the NATO intervention in the ethnic dispute between Albania and Serbia over the benighted province of Kosovo. As part of KFOR (Kosovo Force), B Squadron, The Royal Scots Dragoon Guards, was committed on Operation Agricola 3 with its complement of Challenger 2 MBTs while the other squadrons were 'dismounted'. The heavy armour

BELOW The Trojan AVRE was deployed to Afghanistan in late 2009, together with CRARRV, although Challenger 2 MBT was not employed during Operation Herrick. Throughout the campaign some 60% of Coalition forces' casualties were caused by Improvised Explosive Devices or IEDs so all means possible were used to reduce the risk of exposure to IEDs. Trojan, shown here mounts a Full Width Mine Plough prior to an operation in May 2013.

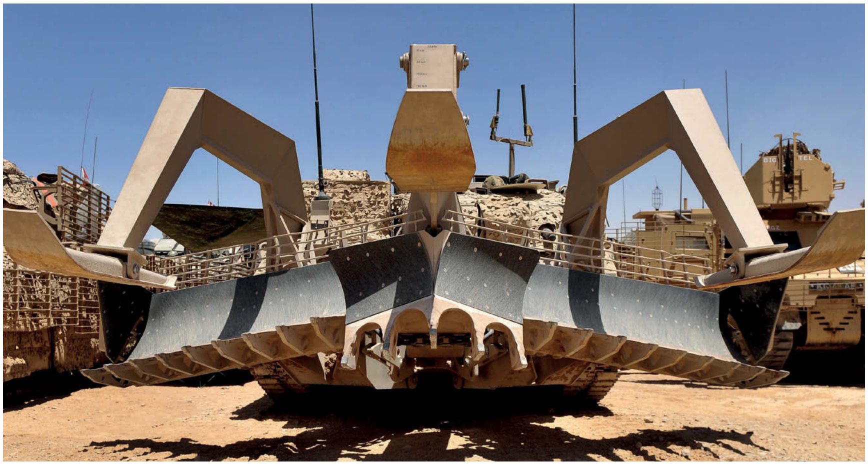
BOTTOM LEFT A Trojan AVRE of 5 Armoured Engineer Squadron ploughs through the sand during Operation Hamkari in support of Afghan and US Forces in Kandahar Province near Sangsar, the spiritual birthplace of the Taliban and the home of Mullah Omar, in November 2010.

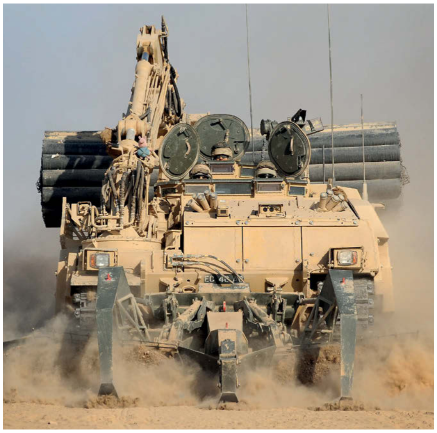
BOTTOM RIGHT On operations, the Trojan incorporates supplementary armour panels along the hull sides as well as bar armour around the rear hull to protect the engine compartment from RPG weapons. As here, the vehicle is also fitted with a Remote Weapon Station on the hull roof armed with a 7.62mm machine gun.

acted as a deterrent force to the warring factions by undertaking road patrols and Vehicle Check Points (VCP) at known flashpoints within the Area of Operations (AOR) of the Multi-National Brigade (Central), such as Gate 3 on the main route from Pristina to Serbia. Extended road marches within the brigade's AOR throughout the six-month roulement were designated Operation Scotsman and acted as a tangible show of force, often covering as much as 250km (155 miles) by road. None of the various ethnic factions in Kosovo deemed it sensible to contest the presence of Challenger 2 during its first operational deployment.

EXERCISE SAIF SAREEA

The volatile situation in the Middle East and Saddam Hussein's continuing refusal to abide by the various resolutions promulgated by the United Nations prompted the British government to conduct a major military exercise in the region to test the Joint Rapid Reaction Force (JRRF) concept in a medium-scale, combined-arms warfighting scenario. Codenamed Exercise Saif Sareea II, 'Swift Sword' in English, it was conducted in Oman in conjunction with His Majesty the Sultan's Armed Forces between September and November 2001. In addition to the main training activity in desert conditions, the UK armed forces proved the deployment process and support structures needed to sustain and recover over 20,000 UK military personnel thousands of miles from their home bases. The deployment involved some 22,500



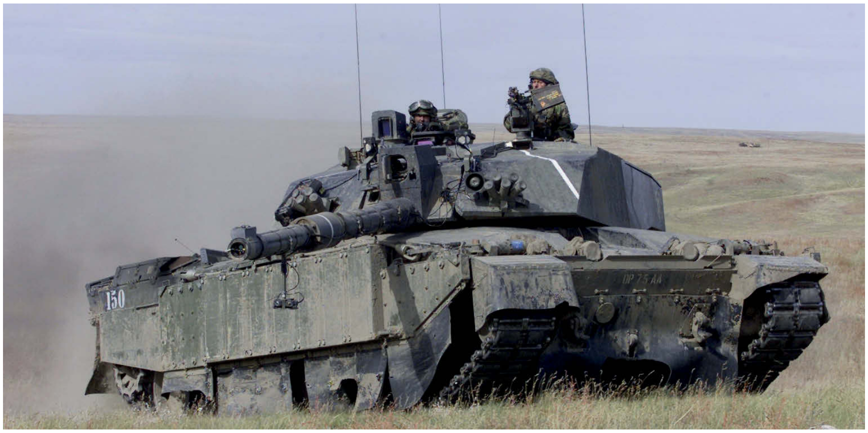


ABOVE Exercise Saif Sareea 2 was a severe test for Challenger 2 under the most arduous conditions of heat and sand in the deserts of South Oman. Due to cost constraints, no particular measures were taken to modify the tanks for such hostile terrain or even painting them in a suitable camouflage scheme. The problems were exacerbated by the woeful lack of logistical support and spare parts, particularly air filters and track pads.

LEFT A Challenger 2 of 3 Troop D Squadron The Royal Dragoon Guards negotiates broken ground at high speed on 25 September 2001 during Exercise Saif Sareea 2, meaning Swift Sword in Arabic. Blocked air filters and shredded trackpads, due to the fine particulate sand and sharp stony ground, became increasing problems during the exercise since spares were in short supply or lost in the logistic train. The face of the loader/operator has been masked to maintain anonymity but to the other members of the regiment it was seen as necessary given that they perceived Trooper 'Face' Brittain to be the ugliest soldier in the British Army.

personnel, 6,500 vehicles and trailers, 93 aircraft of all types and 21 naval vessels at a projected cost of some £90 million. The expeditionary force included 547 AFVs, of which 66 were Challenger 2 MBTs.

The first part of the exercise, comprising British forces alone, was conducted in the hostile desert conditions of the virtually unpopulated southern and central portions of Oman – an area where the Royal Omani Army rarely conducts exercises despite much of its equipment being specially modified for desert conditions, such as their version of Challenger 2. The planners were aware of the difficulties of operating over the appalling terrain and in such arduous conditions, but cost constraints did not allow for any specific modifications to equipment. In particular, it was the advice of the Headquarters Director Royal Armoured Corps (DRAC) for all Challenger 2 MBTs to be fitted with Dorchester Level 2 appliqué armour arrays over the front and sides of the tanks during major exercises such as Saif Sareea to simulate war fighting conditions as closely as possible. It was also known from experience in the Gulf War of 1991 that the side Chobham armour panels reduced the amount of dust being thrown up by the tracks in sandy conditions that could be ingested into the engines and cause severe damage. During the land offensive of Operation Desert Sabre in February 1991 this did not pose a problem as the weather conditions were so foul and the desert sand more gritty. However, the cost of transporting and fitting the armour arrays as well as other



Following Exercise Saif Sareea 2, the Armoured Trials and Development Unit experimented with various dust mitigation aspects for Challenger 2 culminating with a full trial at BATUS in September 2002. It was conducted by Egypt Squadron, 2nd Royal Tank Regiment, during Exercise Iron Anvil. The tanks were fitted with Dorchester Level 2 appliqué armour arrays and thick rubber skirts covering the suspension and attached to the frontal toe plate in a style reminiscent of contemporary Russian MBTs. Note the TES, or Tactical Engagement Simulation equipment, attached to callsign One One of 9th Troop as it charges over the prairie. The design of the dust mitigation skirts was refined in time for Operation Telic, just months away.

'desertization' aspects for Challenger 2 was calculated at £343,000 per tank or over £20 million for 66 tanks: a sum that would have added a further 20 per cent to the overall cost of the exercise. As the principal aim of Saif Sareea was to test the deployment of 3 Commando Brigade, Royal Marines, within the JRRF command structure, the 'desertization' of the Challenger 2 MBTs was not deemed to be feasible within the budget. Furthermore, the appliqué armour arrays in storage would be required if an operational deployment became necessary during the course of the exercise.

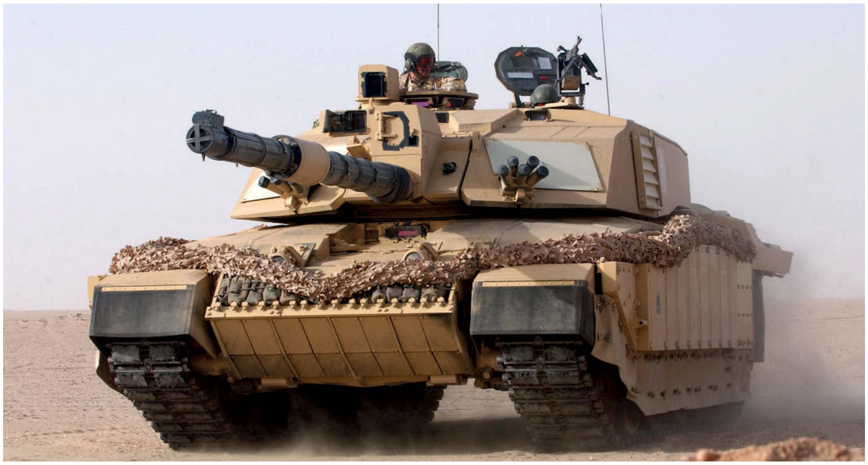
The Challenger 2 force comprised four armoured squadrons of the Royal Dragoon Guards (RDG), as well as headquarters elements and a contingent of the Queen's Royal Lancers (QRL). The RDG had only recently converted to Challenger 2 but had conducted highly successful exercises in Poland and BATUS in Canada. After a period of acclimatization for the troops – the temperatures in Oman rose to 54 degrees C – the tanks were soon put to the test in the harsh conditions. In particular the very fine sand blown up by the tracks rapidly clogged air filters, causing a loss of power in the engines. The rocky ground also took a terrible toll on trackpads and roadwheels. Air filters were now lasting a matter of days instead of months and, under the most extreme conditions, had to be changed after a matter of hours. In north-west Europe, air filters are expected to last up to 12 months before requiring replacement in a normal training year. On average, the 66 tanks in Oman were consuming 46 filters each day at a cost of £1,000 each. The supply of air filters and track consumables in theatre was rapidly becoming exhausted. By the final day of the divisional Exercise Desert Rhino, both A and D Squadrons were able to attack the final objective with just two tanks each. Each of the four RDG squadrons was obliged to stand down a troop of tanks and the QRL contingent was sent home to reduce demands on the supply chain. It was now apparent why the Royal Omani Army did not readily conduct exercises in the south.

Valuable airlift capacity was needed to fly out a consolidated load of spare parts weighing some 55 tons, with air filters being drawn from every source. This prevented the supply of spare parts for the 'B' Vehicle fleet – supply and support vehicles such as Land Rovers and eight-tonners – as well as the helicopters and C-130 Hercules transport aircraft in theatre. Other equipments were also suffering from the hostile conditions, such as the AS-90 self-propelled howitzer and the Lynx battlefield helicopter: the main rotor blades of the latter lasted on average just 27 hours in Oman compared to a life expectancy of 500 in European conditions. The remaining tanks moved to the northern region of the country to take part in a major joint exercise with 12,800 troops of the Royal Omani Army. There the pace of operations was less intense and the conditions less hostile. At the final combined live-firing exercise and firepower demonstration, 42 British and Omani Challenger 2 MBTs were used, with C Squadron RDG firing 400 fin and 300 HESH rounds in three days. But by now the press was publishing alarmist stories about the effectiveness of Challenger 2 that eventually led to a parliamentary enquiry. (See ‘Report by the Comptroller and Auditor General HC 1097 Session 2001–2002: 1 August 2002’, which is overtly critical of the Ministry of Defence on many aspects of equipments employed during Exercise Saif Sareea 2.) However, the fundamental problem was the inadequate scaling of spare parts for the prevailing conditions. This was compounded by a lamentable failure in ‘asset tracking’ within the logistic chain, whereby spares may have been available but their exact whereabouts remained unknown on immediate demand. This was to come back and haunt the British Army during Operation Telic in 2003.

Out of all the NATO members, only the UK and United States have proved the capability of deploying any formation of brigade size or larger in an expeditionary role over such distances and in such a demanding environment. None of the contemporary MBT designs within NATO, such as Ariete, Leclerc or Leopard 2, have fired a shot in anger and therefore remain unproven in battle. Exercise Saif Sareea was a classic example of preparing for the most likely prospect of war in the most difficult circumstances, rather than a casual three-day exercise in Limbourg or Bergen-Hohne during a temperate autumn in Europe. Despite the rugged terrain and conditions, Challenger 2 performed admirably when spares were to hand, although the performance of the tracks gave rise for concern. Plans were set in hand to find a solution. Similarly, the problems of dust ingestion were addressed to make Challenger 2 as battleworthy as possible in desert conditions. Despite the problems, 4th Armoured Brigade still met its Collective Performance Training Standard objective and gained its Lead Armoured Task Force readiness status in January 2002. Attaining this status seemed all the more urgent as the 9/11 terrorist attacks in New York and Washington DC occurred during Exercise Saif Sareea 2, and the prospect of war in the region became ever more likely.

OPERATION TELIC

Space precludes a detailed history of the campaign during the Iraq War of 2003. This account will highlight the performance of Challenger 2 during Operation Telic through typical squadron and troop actions drawn from each of the three armoured regiments

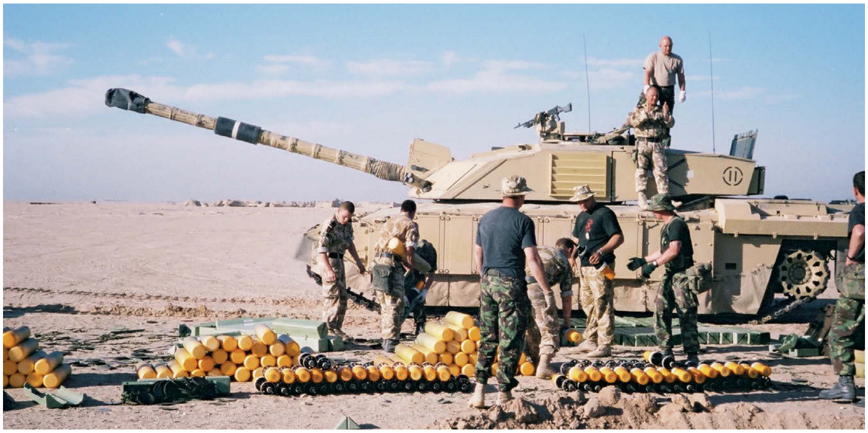


On arrival in Kuwait, the Challenger 2 MBTs were upgraded with increased armour protection and further modifications to suit operating in desert conditions such as this tank of the Queen’s Royal Lancers at Camp Coyote on 13 March 2003. To aid mutual recognition with Coalition forces, the tank turret is adorned with Thermal Identification Panels that appear darker and so cooler than the surrounding steel structure when viewed through thermal imaging sights.

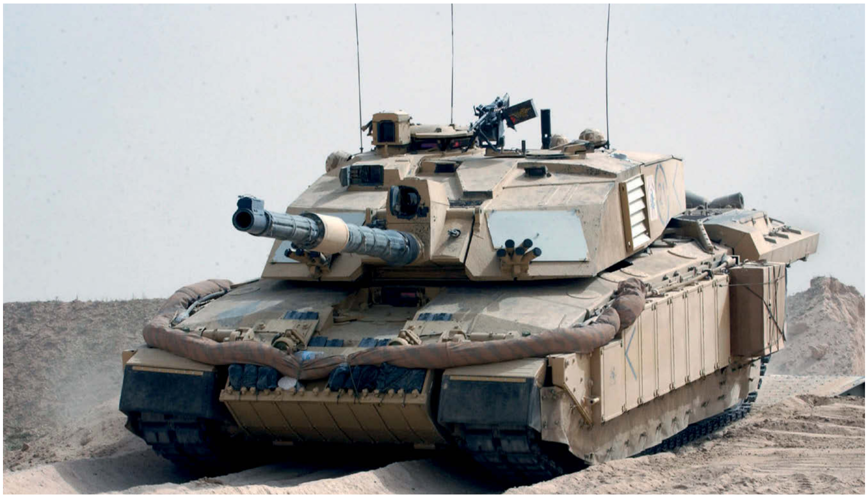
deployed to the region: The Royal Scots Dragoon Guards (Carbiniers and Greys) – SCOTS DG – with A, B and C Squadrons; The Queen's Royal Lancers – QRL – (from 4th Armoured Brigade), with B and C Squadrons and 2nd Royal Tank Regiment – 2 RTR – with Cyclops, Egypt and Falcon Squadrons plus headquarters elements. In all, 7th Armoured Brigade employed 116 Challenger 2 MBTs and 26 CRARRVs during Operation Telic, the British codename for the campaign that the Americans termed Operation Iraqi Freedom. During deployment, the experiences of each regiment were similar, but for the sake of this narrative those of 2 RTR are recounted here.

Following the Christmas and New Year celebrations, the regiment returned to work on 6 January 2003 to be warned of the likelihood of deployment to the Middle East. For the next two weeks, the regiment conducted individual and troop training before conducting a range package at Bergen-Hohne between 20 and 24 January. There followed a combined-arms tactical trainer session at Sennelager from 25 to 27 January. A battlegroup field-training exercise was conducted for the next three days on Bergen-Hohne in blizzards and driving snow with A and D Companies of 1st Battalion, The Light Infantry, in their Warrior IFVs in temperatures as low as minus 17 degrees C: as one Scottish trooper observed, 'Someone tell the squaddies it's the Middle Eastern front, no' the Eastern Front we're supposed tae be fightin' oon.' The training concentrated on squadron/company group manoeuvres against Soviet-style Iraqi dug-in defensive positions, a matter of preparing to fight the Gulf War of 1991 again that would be far removed from the actual conflict to be faced by the troops. During early February, the tanks and vehicles of the various armoured regiments were loaded aboard ships at the port of Emden and despatched to what was termed in operational planning as the 'sandy place' – Kuwait.

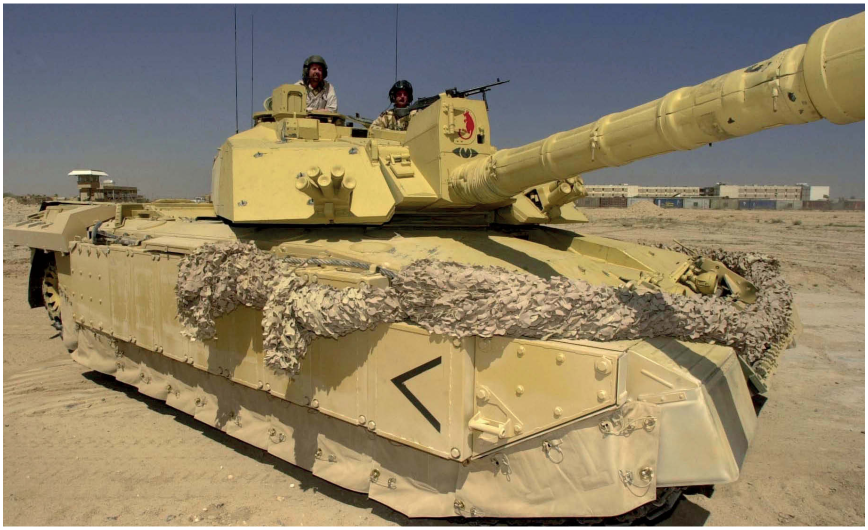
The main body of the regiment's personnel arrived in Kuwait between 5 and 8 March with the tanks arriving on the following day. The tanks were taken to the Udairi range complex close to the Kuwait/Iraq border. From 10 to 13 March, the Challenger 2 MBTs underwent weapons zeroing with the L27A1 DU round followed by a combined arms live-firing exercise. The tanks then moved to the barracks of the Kuwaiti 6th Armoured Brigade where they were up-armoured and fitted with 'desertization' modifications. On 18 March the ammunition arrived and the tanks were 'bombed up'. On the following day, D-Day, 7th Armoured Brigade and 1st (UK) Armoured Division were declared operational, although there remained some shortages of equipment such as new NBC filters for the tanks and personal items of uniform. The war began in earnest on 20 March, G-Day, with a concerted air



Preparing for combat, callsign One One of 9th Troop, Egypt Squadron, 2 RTR, is 'bombed up' on 18 March 2003: a brutal indicator that war is imminent, but only confirmed when the mobile telephones of the troops are impounded for the duration. The black L27A1 APFSDS rounds with their orange protective caps can be seen lying in the foreground with their L17A1 propellant charges behind them. At the outset of the campaign the tanks had an ammunition ratio that was 'fin heavy' in the expectation of engaging Iraqi armour but that soon changed to 'HESH heavy' as few hostile tanks were encountered.



TOP A Challenger 2 of the Queen's Royal Lancers attached to the 1st Royal Regiment of Fusiliers Battlegroup passes through the sand berm on the Iraqi border at the outset of the land offensive during Operation Telic on 23 March 2003. The tank displays the uparmouring package applied to the hull front and sides with Thermal Exhaust Covers at the rear as well as dust mitigation side skirts covering the road wheels. The box on the hull side contains spare air filter 'biscuits'.



LEFT A Challenger 2 MBT of Cyclops Squadron, 2 RTR, displays its newly fitted 'desertization' items of dust mitigation skirts attached to the appliqué side armour panels and extended mud flaps front and rear. Note also the Thermal Exhaust Cowls (TECs) fitted to the exhaust outlets to vent hot gases to the rear and thus reduce the vehicle's heat signature in combat. Other modifications included a revised air filtration system and a new rotary base junction. Note the Cyclops insignia below the red jerboa of the Desert Rats on the door of the TIS barbette and the old-style camouflage netting.

campaign across the length and breadth of Iraq. As the troops waited in the Forward Assembly Area (FAA) on the Kuwait/Iraq border they were subjected to repeated Scud and gas attack alerts. At 0307hrs on 21 March, the Challenger 2 MBTs of 3rd and 4th Troops, B Squadron, The Queen's Royal Lancers, and the Warriors of Y Company, 1st Battalion, The Royal Regiment of Fusiliers (1 RRF), led the assault of 1st (UK) Armoured Division across the border defensive lines and into Iraq.

THE ASSAULT ON AZ ZUBAYR

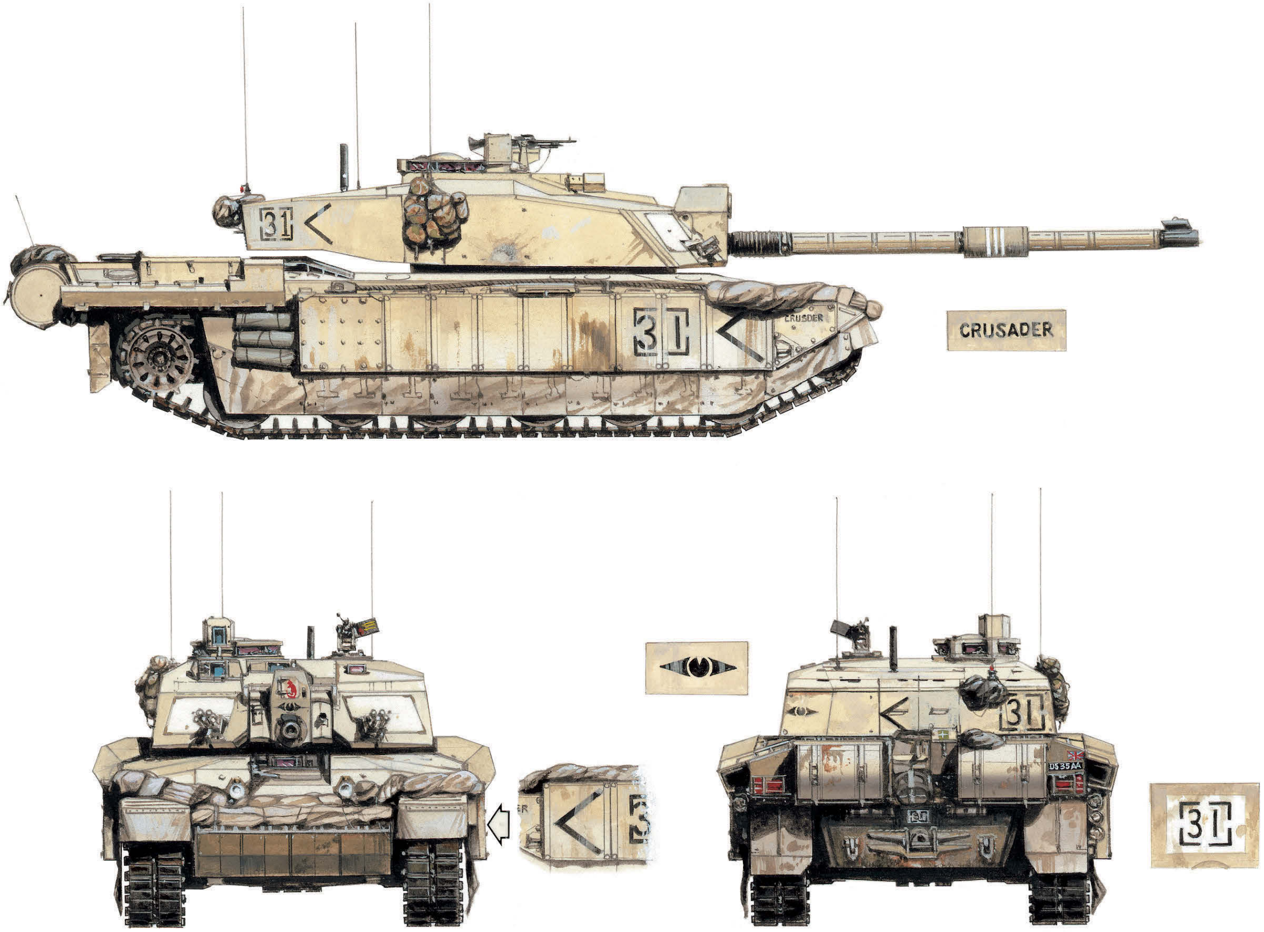
The account now follows the exploits of Cyclops Squadron of 2 RTR in the assault on Az Zubayr to the south west of Iraq's second city of Basra and the principal objective of 1st (UK) Armoured Division. Cyclops Squadron crossed the Kuwait/Iraq border on the morning of Saturday 22 March. It then led the 2 RTR Battlegroup in the clearance of Route Topeka that ran parallel to Highway 8 (Route Tampa), which was the Main Supply Route (MSR) of the US 1st Marine Expeditionary Force – the parent formation for 1st (UK) Armoured Division. This was achieved without incident by nightfall after bypassing numerous deserted enemy positions. Nevertheless, the squadron leader,

With the horizon obscured by explosions, the Challenger 2 MBTs of 7th Troop Cyclops Squadron 2 RTR, advance along Route Topeka towards the town of Az Zubayr soon after crossing the Kuwait/Iraq border on 22 March 2003 at the outset of the ground war. It was a time of considerable trepidation as intelligence reports indicated there were some 200 T-72 MBTs and 100 BMP IFVs lying in wait within miles of the border.

Major Andrew Britton, noted the effectiveness of their camouflage and concealment, with deep fortified vehicle scrapes that covered all avenues of approach. Fortunately, they were abandoned and the squadron took up a night defensive position to the south west of Az Zubayr – AZ to British troops – after relieving A Squadron, SCOTS DG. The task of the squadron was to deny enemy movement out of the western side of AZ and to prevent interference with Route Tampa to the west.

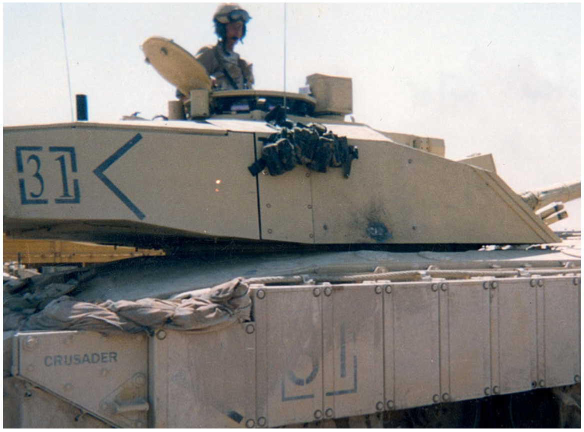
The squadron deployed three of its troops forward, with 8th Troop manning a Vehicle Check Point (VCP), 6th Troop to their south, Callsign Zero Bravo and the Forward Observation Officer (FOO) in overwatch centrally and 7th Troop to the south. Squadron Headquarters, 5th Troop and the LAD (Light Aid Detachment) remained in reserve. As dawn was breaking, an incident occurred at the 8th Troop VCP that led to the tragic death of Sergeant Steven 'TC' Roberts. Despite this setback, Cyclops continued their mission and soon identified the Fedayeen militia headquarters in AZ. A team of snipers moved forward to place the building under observation covered by Three One of 7th Troop (Sergeant Andy Topping), Zero Bravo (Major Andrew Britton) and the FOO (Captain Joe Power) in his Warrior AOP (Artillery Observation Post) in case artillery support became necessary. However, the snipers were spotted and militiamen debouched from the building and engaged the tanks with RPGs and heavy machine-gun fire. The tanks returned fire with coaxial and HESH rounds before retiring with the unscathed sniper team. It was now apparent that the Iraqi forces, both regular and irregular, were trying to lure coalition forces into urban areas where their overwhelming firepower would be minimized and heavy casualties inflicted upon them in costly street-fighting.

Armoured raids against specific targets identified by special forces troops or local intelligence now became the norm in order to minimize civilian casualties and eliminate the enemy militia, or Fedayeen and Ba'ath Party infrastructure. At dawn on 26 March, Cyclops Squadron attacked the militia headquarters supported by precision-guided close air support from US Marine Corps aircraft that destroyed Objective Brain, the militia HQ, without a single shot being fired in return. At noon, the squadron mounted another raid into the town following reports that militiamen were withdrawing from the vicinity of Objective Brain. But this time the enemy was ready with numerous RPG teams waiting in ambush. 7th Troop led the assault in reverse 'V' formation down the main dual carriageway through the town. Three One



CHALLENGER 2, CYCLOPS SQUADRON, 2ND ROYAL TANK REGIMENT, OPERATION TELIC, AZ ZUBAYR, SOUTHERN IRAQ, 26 MARCH 2003

During Operation Telic, all the tanks of Cyclops Squadron had names beginning with the letter ‘C’. Those of 7th Troop were named after former British tanks – ‘CONQUEROR’, ‘COMET’ and ‘CRUSADER’. ‘CRUSADER’ was commanded by Sergeant Andy Topping with Lance Corporal Jason Hammell as loader/operator, Trooper Andy Collens as gunner and Trooper Wayne Lee as driver. The tank took part in a decisive action during the assault on the town of Az Zubayr. The tank is painted overall in sand yellow with black stencilled tactical markings including the vehicle callsign, Three One, on the side armour panels, turret sides and offset to the right on the turret rear within a stencilled square; subsequently the callsign was applied centrally when Thermal Indicator Panels (TIPs) were later fitted to the tank. The square indicates the second squadron within the regiment, in this case Cyclops Squadron within 2 RTR, and the three white rings on the fume extractor of the main armament the third troop in the squadron, in this case 7th Troop. This is repeated on the lower rear hull plate as a convoy distance marker and vehicle-identifying marker during night replenishments. The leftward-facing black chevron was the mutual recognition device for the Coalition forces. It is painted on the turret sides and offset to the left on the turret rear as well as on the side armour panels. The vehicle name, ‘CRUSADER’, is painted on each forward side armour panel. The VRN DS35AA is applied at the top right of the rear hull plate together with a Union Flag. On the door of the TIS barbette housing is the red jerboa of 7th Armoured Brigade – the Desert Rats. Beneath that is the insignia of Cyclops Squadron. This is repeated offset to the left on the rear of the turret. The tank carried combat indicator panels (CIPs) on each front face of the turret but no TIPs on turret sides or rear during the action at Az Zubayr, although the mounting holes had been drilled. There was a shortage of TIPs at the outset but they were later added to each side of the turret rear obscuring the rear-facing callsign, which was reapplied centrally between the black chevron and squadron insignia. The crew’s personal kitbags were hung from the radio antennae; although they were prone to combat damage there was insufficient space to stow them inside the tank. Due to a shortage of supplies, Three One did not display an air recognition panel during the action at Az Zubyar.



‘CRUSADER’, the Challenger 2 of the Troop Sergeant, Sergeant Andy Topping, of 7 Troop Cyclops Squadron 2 RTR, halts at the replenishment point after the decisive action at Az Zubayr on 26 March 2003 when the tanks of 7th Troop were hit repeatedly by RPG rockets without any significant damage. Note the impact point of an RPG-7 on the turret side of callsign Three One.

CRUSADER under the command of Sergeant Andy Topping was on the left with Three Zero CONQUEROR (Lieutenant Sam Clarke) in the centre and Three Two COMET (Corporal Joe Dale) on the right followed closely by Zero Bravo CYCLOPS and the squadron leader, Major Andy Britton, with 5th Troop following up behind. With extraordinary courage, the militia RPG teams opened fire at the charging 65-tonne tanks at virtually point-blank range.

As 7th Troop was passing the town hospital close to a crossroads, Three One was struck by an RPG-7 round in the turret side, which had no effect beyond blasting the crew’s personal effects hanging on the exterior of the tank. Sergeant Topping immediately traversed his turret and engaged the two militiamen with coaxial machine-gun fire at a range of 10m, killing them both. A second four-man militia team was positioned at the base of a building across the junction behind a low stone wall. This team engaged and hit Three Zero with an RPG at a range of 40m, striking the turret armour but causing no damage. Again, Sergeant Topping quickly spotted the enemy and engaged them with a 120mm HESH round, killing them all. Another militia team was engaging Three Zero with RPG rockets and small-arms fire from the upper floor of a building to their front. Sergeant Topping again engaged with a HESH round causing the complete destruction of the firing position. He then provided further effective suppressive coaxial machine-gun fire in support of his troop as the squadron group passed through and beyond 7th Troop to Objective Brain. On the route back towards the squadron location, Sergeant Topping spotted militia activity around a static MTLB APC in the vicinity of the hospital close to the original ambush site. Observing militiamen with RPG weapons, he opened fire with three rounds of HESH, killing the assailants. The complete contact lasted approximately 15 minutes. Sergeant Andrew Topping received a ‘Commander’s Commendation’ from the OC, 7th Armoured Brigade, for his professionalism and that of the crew of CRUSADER.

This was a defining action as it proved Challenger 2 had a high survivability rate against Iraqi infantry anti-tank weapons, even in an urban environment without infantry support, which was traditionally a completely unacceptable tactical scenario for tanks. The three Challenger 2 MBTs of 7th Troop, Cyclops Squadron, suffered

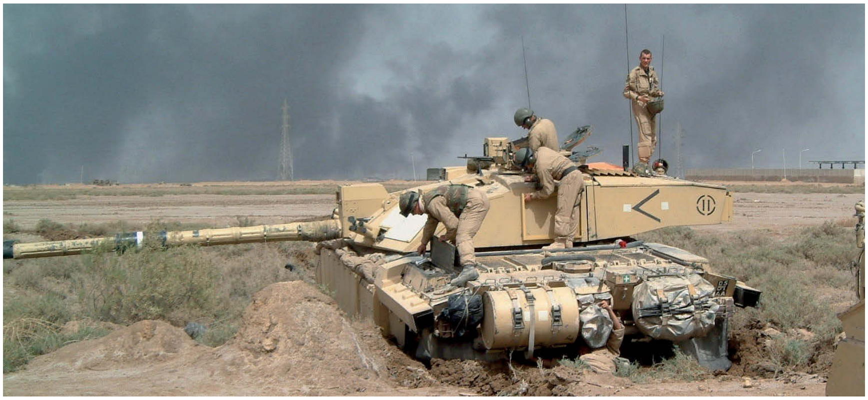
A Challenger 2 of Egypt Squadron 2nd Royal Tank Regiment forms a Vehicle Check Point at Az Zubayr on 1 April 2003 during Operation Telic. Egypt Squadron was part of the 1st Black Watch Battlegroup during the advance into Iraq. Tanks of EGYPT Squadron began with the letter E and this Challenger 2 is named ENDURANCE above the leftward facing black chevron that acted as the mutual recognition device of the Coalition Forces. The other squadrons in 2 RTR were BADGER, CYCLOPS and FALCON, with the latter two being part of the 2 RTR Battle Group.

seven direct hits from RPG rockets with no significant damage to the tanks or injury to their crews. Operational planning now capitalized on the overt power presence of Challenger 2, with its immediate and flexible firepower for undertaking shock attacks that reduced the need for the infantry to dismount from their Warrior IFVs in the face of concerted small-arms fire. This led to the innovative tactic of undertaking 'raid and aid' operations throughout the British area of operations, using intelligence drawn from numerous sources and striking at the key positions held by the militia or Ba'ath Party officials. Following the raid, humanitarian aid was then provided to the local populace as a means to promote confidence in the coalition forces.

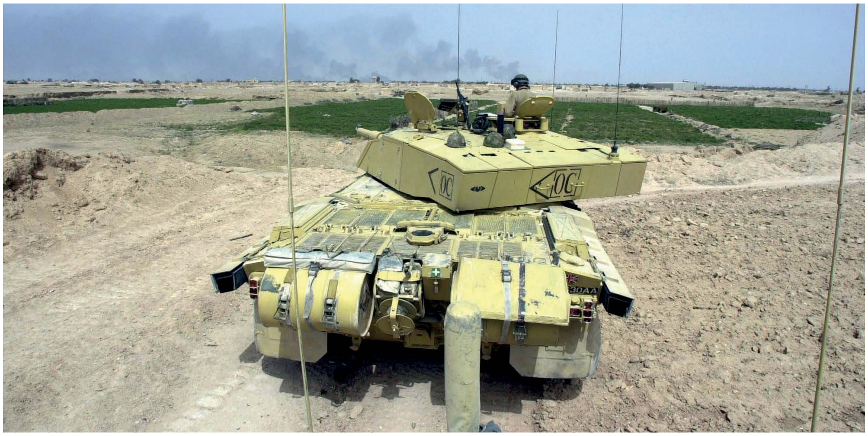
THE ADVANCE ON BASRA

Meanwhile, B and C Squadrons, The Queen's Royal Lancers, were operating in support of the First Fusiliers Battlegroup in the 'battle for the bridges' over the Shatt-Al-Basra on the western approaches to the city. The fighting was ferocious and sustained as the four battlegroups of 7th Armoured Brigade and 3rd Commando Brigade, Royal Marines, tightened their grip around Basra. At 0120hrs on 25 March, a tragic 'friendly fire' incident occurred to the south west of Bridge 3, codenamed Leicester, when callsign One Two of C Squadron, QRL, was struck by a 120mm HESH round fired by a Challenger 2 of the 1st Black Watch battlegroup. The commander, Corporal Steven Allbutt, and the driver, Trooper David Clarke, were killed outright and the remainder of the crew, Lance Corporal Twiddy and Trooper Julien, critically injured. That anyone survived at all was miraculous. It was a severe

BELOW LEFT Egypt in Iraq – callsign One One of 9th Troop, Egypt Squadron, 2 RTR, comes to grief in soft terrain. The leftward-facing black chevron was the mutual recognition sign of the Coalition forces; the white squares to either side are an indicator of the tank and troop within the squadron. Egypt Squadron was attached to the 1st Black Watch Battlegroup, as was A Squadron, SCOTS DG.



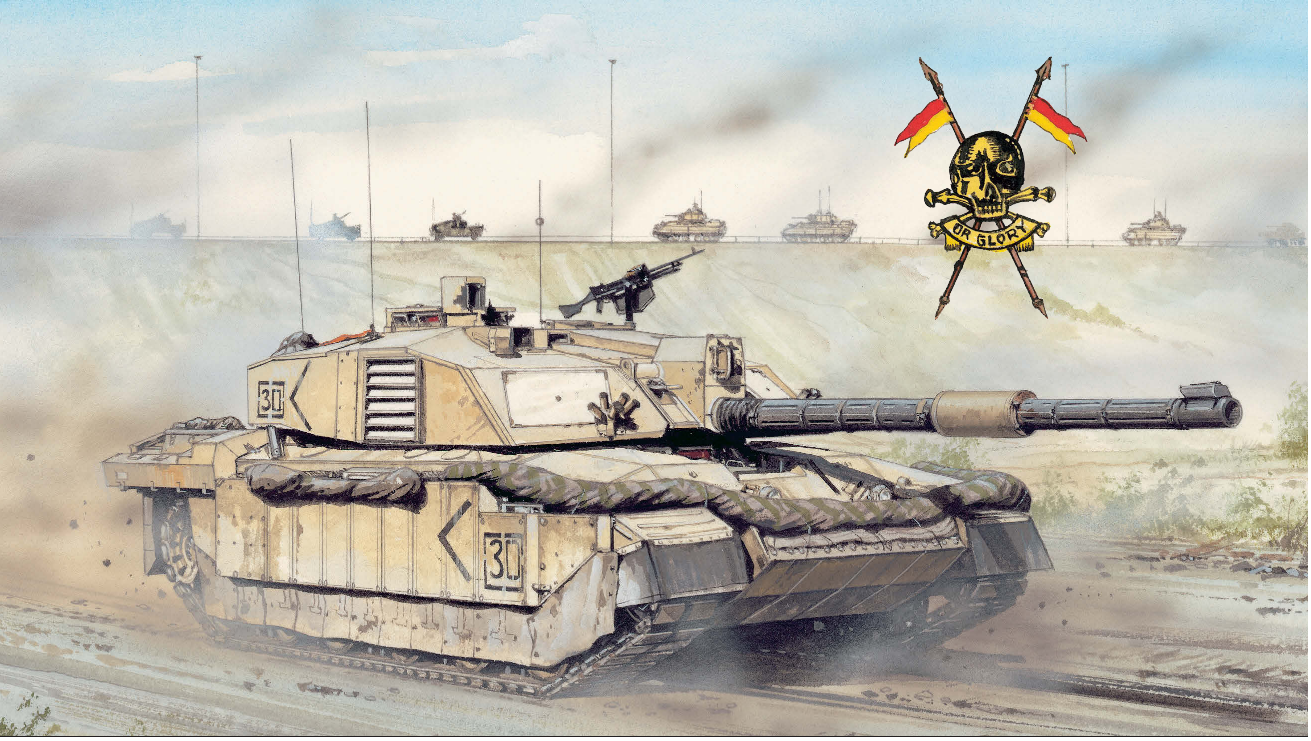
BOTTOM Zero Charlie, the Challenger 2 of the second-in-command (2i/c) of Cyclops Squadron, 2 RTR, takes up position among the tomato fields on the outskirts of Az Zubayr. Of particular note is the position of the GPS antenna, just visible behind the loader's hatch, and the white box of the Blue Force Tracker on the turret roof. As its name implies, this device assisted in identifying the positions of friendly forces and was commonly fitted to the tank of the 2i/c in each armoured squadron.



blow to the battlegroup but the war continued unabated. Major Giles Harrison, the commander of B Squadron QRL, takes up the story of the battle for Basra:

> At 0230hrs ZULU [0630hrs local time] on Wednesday 3 April 2003, three tanks from B Squadron supported by 12 Platoon [Lieutenant Chris Rees-Gay] from Z Company [1 RRF] and a section of MILAN, moved forward to the road overpass known as the 'Loop' to put in a Vehicle Check Point (VCP) which changed the timetable for the liberation of Basra. The Brigade Commander [Brigadier Graham Binns] had given permission for a bold move forward, which would send a message to the enemy that Coalition Forces were ready and poised to take the city. Without laying siege to Basra itself, the enemy were being sent an unequivocal message that the Coalition was in control. It was a gamble; this was the furthest forward that friendly forces had been allowed to push and many anticipated that B Squadron Group would be pushed off the 'Loop' by superior enemy firepower. The plan was for two tanks to move up the slip roads on to the overpass, to cover east and west, whilst one tank pushed forward under the road bridge to cover north. The four Warriors would then move up on to the overpass and put in the VCP, with their vehicles split into pairs orientated in different directions, this would allow them to stop two-way traffic and prevent the possibility of a drive-by shooting.
>
> In the event, and predictably, the plan did not survive contact with the enemy. As the Warriors were pulling into position, the lead vehicle spotted a T-55 at about 1,000m with its turret traversing to bring the main armament to bear. Tank callsign Zero Bravo [the squadron leader's tank] pulled forward and engaged, first with HESH and then with DU to make sure. As soon as the DU round hit, the enemy tank started to brew up – a confirmed kill. At the same time callsign Two One [Sergeant Gardner], under the bridge, began to report activity from a large number of enemy RPG teams that were moving into position to his front. I realized that unless I committed more combat power I would run the risk of being forced back. I decided to call forward Three Zero [Staff Sergeant Southam] and Three Two [Corporal Driver]; Three Zero moved under the bridge to support Two One, Three Two moved up on to the overpass to support Two Two [Corporal Uprichard] who was orientated east and had spotted further RPG teams in the buildings to his front. The plan worked. Callsign Three Zero immediately took control of the situation and kept me informed as he and Two One dealt with the enemy dismounts. Once an RPG team took refuge in a building to avoid the scything coax fire, the tanks would drop the building with HESH. This tactic served to demoralize the enemy who had no means of replying.
>
> The commander of 1 RRF Battlegroup [Lieutenant Colonel David Paterson], who had been watching our progress with interest, called me back to the slip road on to the

Callsign One Two of 5th Troop, Cyclops Squadron, 2 RTR, approaches the remains of the Ba'ath Party headquarters in Az Zubayr – Objective Brain – after the attacks of 26 March 2003 by a JDAM bomb and concerted tank fire.

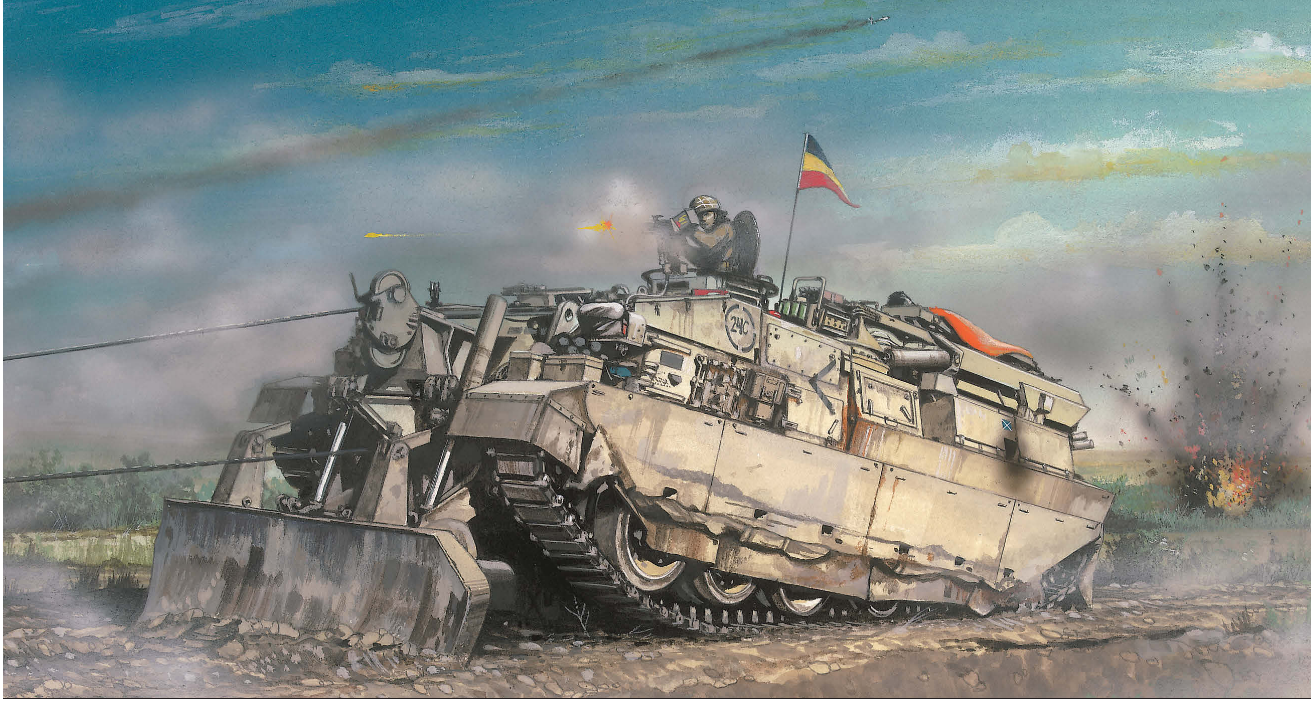


CHALLENGER 2, B SQUADRON, THE QUEEN'S ROYAL LANCERS, OPERATION TELIC, 'THE LOOP', BASRA, SOUTHERN IRAQ, 3 APRIL 2003

This Challenger 2 is the mount of Staff Sergeant John Southam, the troop leader of Three Troop, B Squadron, QRL, during the action at the 'Loop'. The callsign, Three Zero, is painted on the side armour panels and rear quarters of the turret sides. A detachable black plate, outlined in a yellow square representing B Squadron, combined with the vehicle callsign also in yellow, is attached centrally to the rear of the turret. Three Zero indicates the troop leader as does the tennis ball impaled on the right rear radio antenna as viewed in the colour plate: a device peculiar to the QRL to indicate commanders' tanks. The crossed lances and pennants of The Queen's Royal Lancers is displayed on the left-hand side of the turret behind the TIP and forward of the rear-facing black chevron that is also applied to the side armour panels. CIPs are carried on the front faces of the turret and two further four-louvre TIPs are attached to the rear of the turret. Again an orange air-identification panel is visible on the top of the turret. Draped round the front of the vehicle is an Israeli camouflage net. Characteristic of many QRL tanks during Operation Telic, the thermal sleeve of the main armament was not painted in desert yellow. The rest of the crew comprised Corporal Burnett as loader/operator, Trooper Spiers-King as gunner and Trooper Whitby as driver. Sergeant Southam was Mentioned in Despatches for his actions at the 'Loop'.

'Loop' for a quick conference; he was content that we probe the enemy whilst continuing with our task. This seemed to me to be an excellent idea. About two hours into the task, the US Field Human-Intelligence Team (FHT) equipped with Arab speakers was cut to me. They proved to be extremely useful and we started to gain some excellent intelligence. Perhaps the most significant fact learned was that the Coalition had the Basra University and the Naval Academy marked incorrectly on our maps. We were also told that the University had two T-55s on guard outside it. I realized from a quick map recce that, if this was so, then the first tank that had been destroyed was probably one of the reported T-55s. I called forward Four Zero [Captain Horne] to act as wingman, and together we pushed forward to have a look. As Zero Bravo rounded the corner leading to the University my driver spotted a T-55 at 400m, the gunner pumped a DU round into it and into a military truck that seemed somewhat surprised to see us. We had now confirmed the location of Basra University.

Meanwhile, under the bridge, Three Zero and Two One were still fighting hard. I decided to commit Four Zero to the fray. It was now apparent that it was in this area that



CHALLENGER ARMOURED REPAIR AND RECOVERY VEHICLE, LIGHT AID DETACHMENT, ROYAL ELECTRICAL AND MECHANICAL ENGINEERS, C SQUADRON, THE ROYAL SCOTS DRAGOON GUARDS, OPERATION TELIC, AL FAW PENINSULA, SOUTHERN IRAQ, 30 MARCH 2003

With its callsign, Two Four Charlie, this CRARRV is depicted during the recovery operation portrayed in these pages. The vehicle is painted overall in desert yellow and is fitted with dust mitigation skirts. On each side is the vehicle callsign of Two Four Charlie within a circle denoting C Squadron, SCOTS DG, as is the Saltire just above the vehicle exhaust outlets. As a mutual recognition device, the CRARRV has a left-facing black chevron on each side. The VRN is 46KJ89 carried front and rear. Lashed to the gun planks on the hydraulic crane is an orange air-identification panel and there is a further fluorescent orange rectangular safety marker painted on the very top of the jib. With the failing light, the recovery mechanic, Corporal Justin Simons, was obliged to use cutting equipment that highlighted his position and the CRARRV to the enemy as the vehicle commander, Corporal James Garrett, gave covering fire with his roof-mounted L37A2 7.62mm machine gun. Throughout the action, the flag of the Corps of Royal Electrical and Mechanical Engineers flew from the CRARRV's radio antenna. The REME crew of Two Four Charlie comprised Corporal Jay Garrett, Corporal Justin Simons, Corporal Rick Parker, together with Corporal John Morgan.

the enemy were concentrating their Main Effort. Shortly after this decision, we were mortared for the first time that day. Luckily for us, the enemy seemed pretty bad at adjusting fire, although it was somewhat poetic that the FOO [Forward Observation Officer] got his Raven sight knocked out by the first round. The indirect fire did not affect our mission. Challengers and Warriors closed down, I ordered the majority of the dismounts to remount and await further orders. The FHT pulled back from the 'Loop' until the mortar fire died down because they were mounted in Hummers. Under the bridge the makeshift troop pushed forward; they discovered a number of enemy mechanical diggers and the start of an earthwork, obviously designed to delay our progress into Basra. The diggers were destroyed to prevent their further use. The 'Troop' even got eyes on to the Iraqi Naval Academy and despite constant fierce fighting, during which Two One was hit by an RPG that failed to detonate, they brought in an effective fire mission killing over 30 combatants inside the Academy.

Once the indirect fire had stopped, I called back the FHT and carried on with the VCP. I was determined to collapse the VCP on my terms, not the enemy's. After ten hours we had largely silenced enemy resistance, and callsigns Two One, Three Zero and Four Zero were dangerously low on ammunition, at this point I decided to pull back. That

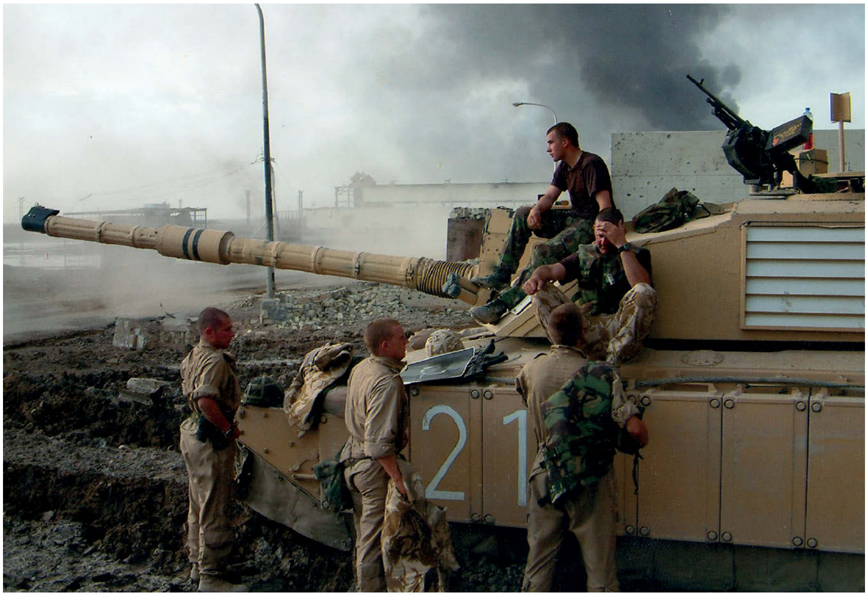
> evening, the GOC [Maj Gen Robin Brims] and the Brigade Commander congratulated the squadron on a job well done and staff officers stopped saying that Basra would not fall until after Baghdad.

REME TO THE RESCUE

Further to the south, the SCOTS DG Battlegroup was acting as the brigade reserve, although A Squadron was part of 1st Black Watch Battlegroup and C Squadron was attached as armour support to 3 Commando Brigade, Royal Marines, operating in the Al Faw Peninsula. There, C Squadron – 'Cruel C' – conducted Operation James between 29 and 31 March in conjunction with 40 Commando, Royal Marines, as they advanced into the area of Abu-al-Khasib, a suburb south of Basra. The marshy salt flats of the peninsula were particularly poor terrain for the 65-tonne tanks and movement was often precarious and difficult, with the tanks confined to the narrow, raised earthen causeways more suited to horse and cart than AFVs. On the morning of 30 March, Delta Company, 40 Commando, Royal Marines, supported by 2 Troop, C Squadron, was tasked with the capture of two objectives rejoicing in the codenames of Pussy and Galore – Operation James referred to James Bond and all the objectives were given names drawn from the Ian Fleming novels. Callsign Two Two was in the van followed by Two One, commanded by Sergeant David Baird, and Two Zero interspersed with the Commandos in their Pinzgauer trucks, while in support were the squadron leader, Major Jonathan Biggart, in Zero Bravo, the FOO in his Warrior AOP and a CRARRV, callsign Three Three Bravo, from 2nd Battalion REME, commanded by Corporal John Morgan. Their target was a crossroads that commanded the southern approaches to Basra.

The causeway was so narrow that the tanks and trucks advanced on a single vehicle frontage; deep ditches to each side also made manoeuvring nigh on impossible. Soon after 1130hrs, as the advancing force neared the crossroads, it came under concerted RPG and machine-gun fire from a group of mud shacks and buildings to the left front. Two Two was soon hit four times by RPGs and was forced to withdraw. Other Fedayeen rushed forward grasping children in one hand and weapons in the other. Sergeant Baird in Two One forbade his crew to return fire until the children broke free and escaped. A single HESH round killed six militiamen followed by coaxial machine-gun fire that eliminated a dozen more. The first enemy burst of automatic fire smashed the driver's vision block of Two One so that Trooper Ilivia 'Mac' Macawai from Fiji could no longer see anything; an RPG round also struck the right-hand headlight. With reckless determination, the enemy closed with the tanks and concentrated their fire at the vehicle sights. In short order, RPG rockets destroyed the gunner's primary sight as well as the coaxial chain gun and left-hand smoke discharger. Another RPG impacted on the turret roof and, in the ensuing explosion, two of the commander's rear-view vision blocks were destroyed. The driver now had no forward vision and the commander very little to the rear. Inside the blinded tank, nerves were becoming strained. The tank commander, Sergeant Baird, calmly ordered the driver to reverse but an empty Commando Pinzgauer truck blocked the withdrawal. Intending to push it aside, Sergeant Baird gave the order 'left stick' to direct the driver. Unfortunately, the inexperienced Trooper Macawai, who had only been with the regiment since Christmas, pulled the right stick instead, causing the tank to veer off the causeway into a deep ditch, shedding both tracks.

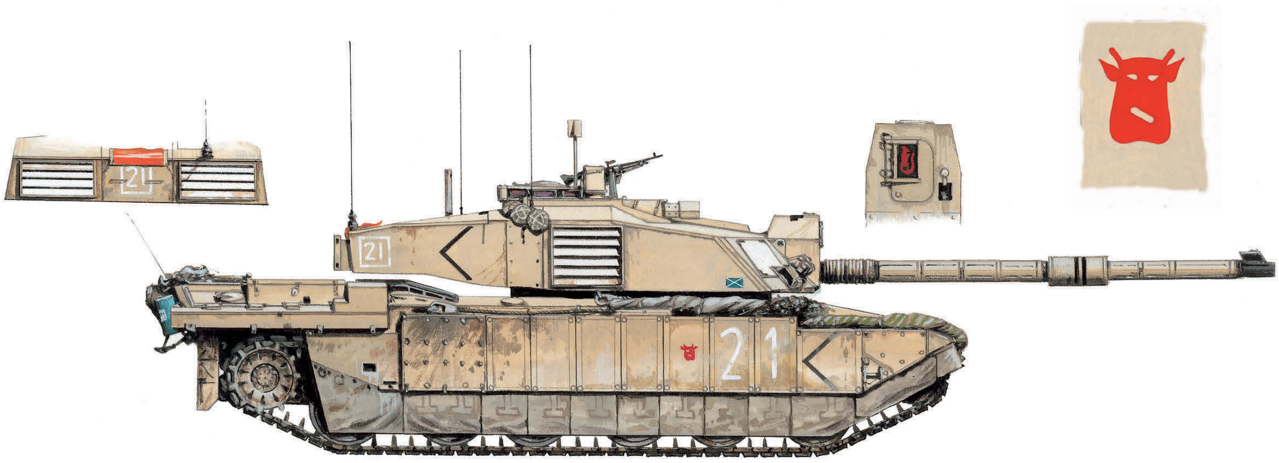
The other tanks jockeyed into position to provide suppressive fire on the enemy. The FOO called for a fire mission from the supporting 105mm Light Guns of 29 Commando,



With Basra burning in the background, the exhausted crew of Two One, B Squadron, SCOTS DG catch a moment's rest after removing their helmets and body armour at the end of hostilities on 7 April 2003.

Royal Artillery. Inside Two One things went from bad to worse when a wire-guided anti-tank projectile struck the front of the turret, flinging the loader, Trooper William Frazer, backwards and breaking his wrist. Eventually, the enemy fire slackened under the sustained bombardment of tank and artillery shells, although sporadic small-arms and mortar fire continued. It was time to recover the stricken Two One from the ditch. With considerable difficulty, CRARRV Three Three Bravo moved forward to the site but the situation was dire. With both tracks shed and jammed around the suspension under great tension, the tank was completely immobile. It would require a pull in excess of 100 tonnes, which was beyond the capability of even the powerful CRARRV. And so it proved when the winch of Three Three Bravo failed under the effort. The CRARRV was obliged to withdraw, taking with it the injured loader from Two One for medical treatment as well as its gunner, Trooper Stuart Ferguson.

The C Squadron REME Light Aid Detachment was called forward with its CRARRV, callsign Two Four Charlie, commanded by Corporal James Garrett with recovery mechanic Corporal Justin Simons and technician Corporal Rick Parker. As it approached the site, Two Four Charlie picked up Corporal John Morgan, the commander of CRARRV Three Three Bravo. The disabled Challenger 2, Two One, was still under enemy fire as the light began to fail in the late afternoon. At the outset, Two Four Charlie fired its smoke-grenade dischargers to mask the recovery operation as Corporals Morgan, Simons and Parker attached the winch rope to the stranded tank and gently pulled it on to the causeway; however, the angle was so acute and the roadway so narrow that it slid down the opposite side into an even more difficult position. In addition, the winch rope of Two Four Charlie snapped, so both CRARRVs were now for all intents and purposes out of action. Undeterred, the REME team tried to break the tracks with conventional tools but the tension was much too great. As darkness fell the enemy returned in strength, attempting to infiltrate the position, but Corporal Garrett laid down effective suppressive fire from his roof-mounted machine gun as the mechanics continued with the recovery operation. Throughout, the other tanks provided supporting fire and artillery fired HE and smoke shells to mask the scene.



CHALLENGER 2, B SQUADRON, THE ROYAL SCOTS DRAGOON GUARDS (CARBINIERS AND GREYS), OPERATION TELIC, BASRA, SOUTHERN IRAQ, 6 APRIL 2003

Under the command of Sergeant Andy Potter, Two One is depicted during the battle on Route Red during the final assault on Basra codenamed Operation Sinbad; the other ‘Mutant’ crewmen were Trooper Kevin Young as loader/operator, Trooper Callum Griffiths as gunner and Trooper ‘Doc’ Docherty as driver. The tank is fitted with the full panoply of CIPs and TIPs on all turret faces as well as Dorchester Level 2E armour, thermal exhaust cowls (TECs) and dust mitigation skirts. The callsign, Two One, is painted in white on the turret sides and rear as well as on the side armour panels. The two black rings around the fume extractor denote B Squadron, as does the square metal device on a stalk beside the commander’s cupola. This is a thermal indicator and is peculiar to the SCOTS DG. A triangular one signifies A Squadron, square B, circular C and rectangular D. However, C Squadron has taken the system one step further with two shapes on the stalk. With the circular C Squadron sign at the bottom, the same shapes are added above to show each troop within the squadron. Thus, a triangle above the circle indicates 1st Troop of C Squadron and so on – two circles being 3rd Troop, C Squadron. These shapes are visible through TOGS at night and in poor visibility. Another indicator of the Beautiful B is the ‘Mutant’ squadron insignia emblazoned on the side armour panel behind the callsign.

Not known for being the most handsome personnel in the regiment, the term ‘Mutants’ originated with Sergeant ‘Tam’ Spence and was encapsulated in a graphic design created by Lance Corporal Frankie Kyle. It now adorns much B Squadron equipment. Taped to the top of the TIS barbette is a small Union flag and an orange air-recognition panel is lashed to the turret roof. A small Saltire adorns each side of the turret at the forward bottom edge. The VRN DR17AA appears on the top right of the rear hull plate.

By now the darkness was interspersed with the crump of impacting mortar rounds combined with the lazy arcs of tracer fire and RPG rockets as the enemy tried to disrupt the recovery operation, forcing the REME mechanics to dive for cover when enemy small-arms and RPG fire fell close by before returning to the task in hand. Corporal Simons resorted to desperate measures by trying to cut the tracks with arc-welding equipment that highlighted his position to the enemy in the darkness. This too failed. Eventually, he decided on a most unorthodox recovery technique whereby he combined the two CRARRVs, Two Four Charlie and Three Three Bravo, which had returned to the scene, together by chains, and with A-frame drawbars attached to the victim from Two Four Charlie. This audacious method was successful and, some 14 hours after the original incident, Two One was dragged back to friendly lines some 3km away. Within four days Two One was repaired with new sights, road wheels and tracks. It had been hit a total of eight times by RPGs and an ATGW missile without penetration of the crew compartments. For their professional diligence and bravery under fire, Corporals Garrett and Simons of the Royal Electrical and Mechanical Engineers were both Mentioned in Despatches.

THE BATTLE FOR BASRA

By the first week of April, Basra was ripe for the plucking. The Ba'ath Party and both regular and militia forces had been seriously degraded by repeated raids and precision aerial attacks without causing undue casualties among the civilian populace. All the battlegroups of 1st (UK) Armoured Division were steadily encroaching on the city. By now, B Squadron SCOTS DG were based at a camp known as Dundee from where they mounted raids into the city. On Thursday 3 April, the squadron conducted a raid along Route Red, the codename for the southwestern highway into Basra, in conjunction with Nos.1 and 2 Companies of the Irish Guards in their Warrior IFVs. By early morning, the infantry was well ensconced in the primary objective that was the Technical College just beyond Bridge 4. To increase the pressure on the enemy, several raids a day were undertaken with the tank troopers working 22 out of 24 hours; guarding, patrolling, fighting and finally maintaining the tanks for the next round with perhaps a few minutes' sleep. All the while the tenacious enemy fought with great determination and never faltered in the face of the overwhelming onslaught of the Coalition forces.

On Saturday 6 April, three troops of B Squadron, as well as Squadron Headquarters, raided further along Route Red as the tanks destroyed any barricades across their path. Captain Ran de Silva, 2nd Troop leader, and his crew had a rude shock when a seemingly abandoned T-55 fired a 100mm round that struck the central ERA panel protecting the nose of their Challenger 2. After a spectacular explosion, there was no penetration of the tank. Within seconds, the whole troop opened up on the hapless T-55, destroying the enemy tank completely. The tanks now passed a complex of buildings identified as a Ba'ath Party command and control centre. Like ships of the line, the tanks fired broadsides into the buildings and bunker positions as well as the lattice communications tower of a nearby television station, an event recorded for British television by a camera mounted on the turret of Zero Bravo, the Challenger 2 of the squadron leader, Major Chris Brannigan. The raid was deemed so successful that yet another was planned for the following day.

B Squadron was tasked to mount a deeper raid along Route Red as far as Objective Granite, a place known as the 'Gateway to Basra' – symbolically, whoever held the

A looter drags his booty under the barrel of a Challenger 2 at Basra University in the southern Iraqi port on 07 April 2003 as fighting for the city subsided. (Getty Images) gateway held the city. It was to be another exhausting day for the SCOTS DG Battlegroup and the 'Mutants' of B Squadron who were in the van once more. The 2nd and 4th Troops led the advance to provide a base of fire at RED 4 as 1st and 3rd Troops passed through and on towards the College of Literature, or Objective Elysium. There a brisk firefight ensued, with 3rd Troop destroying numerous bunker positions and resulting in widespread enemy casualties. It was hard pounding all day as the Mutants advanced into Basra, causing the systematic destruction of enemy positions and AFVs. By midday, 3rd Troop had expended virtually all of their main armament ammunition and were relieved in place by 2nd Troop. Attention now returned to the College of Literature that remained uncleared of the enemy. Supported by 5th Platoon, No.2 Company, Irish Guards, Zero Bravo smashed through the front gates followed by Zero Charlie and 2nd Troop to find the ground littered with bodies. The infantry were called forward in their Warriors to search the complex.

Suddenly, the bodies rose up from 'dead' and began to engage the tanks and Warriors with RPGs and small-arms fire. A desperate close-quarter struggle ensued. One unfortunate militiaman met his death in an unequal 25m engagement between his Kalashnikov and a 120mm HESH round from a Challenger 2, while another was crushed by tank tracks as he rose to fire his RPG. No.1 Company, Irish Guards, rushed forward and dismounted from their Warriors to clear the complex although it was much too great a task for a single infantry company. Nevertheless, the enemy was eventually subdued, although not without casualties. As the light was failing, another militiaman feigning death rose up from the shadows and fired into the back of a Warrior, killing two guardsmen and seriously wounding two others. When the dead were searched later, most of them turned out to be foreign nationals from Tunisia, Morocco, Egypt, Syria and other Arab states that had come to Iraq to fight for Saddam Hussein against the Coalition forces. None of them was able to use the return portion of the airline tickets found in their kitbags.

After many hours of fierce fighting, the exhausted Mutants were relieved in place by C Squadron at 1500hrs. They returned to Dundee to replenish their tanks and undertake essential maintenance tasks with the promise that they would be stood down for at least 12 hours for rest and recuperation. Four hours later, the squadron was tasked to support 3rd Parachute Battalion in a further assault into the oldest part of Basra, a maze of alleyways and narrow streets hardly suited to 65-tonne MBTs. A troop of tanks was attached to each Para company with Squadron Headquarters joining 3 PARA Tactical HQ. The clearance operation began at first light. The mood in the city was strikingly different from the day before. Resistance melted away and the local populace came out to greet the troops as the battlegroups of 1st (UK) Armoured Division linked up in the centre of Basra. Within minutes, crew helmets were exchanged for grey, black, maroon or green berets, as well as hackles and tam-o'-shanters. The transition from war fighting to peace-support operations was as sudden as it was welcome. Then the looting began.

OPERATION TELIC 4: A SQUADRON QUEEN'S ROYAL LANCERS

Following Operation Telic, all the Challenger 2 tanks were withdrawn except for a single squadron that was stored at Umm Qasr. None was deployed on the next two Telic roulements as the situation on the ground was largely benign. However, Operation Telic 4 from April to November 2004 was completely different: in the jargon of the time, it was to be highly 'kinetic', as this account by Colonel James Coward QRL attests:

During OP TELIC 4, A Squadron QRL was attached to the 1st Battalion Princess of Wales's Royal Regiment Battle Group acting in the role as the Maysan Province Battle Group in Southern Iraq. As a Light Role Squadron without tanks, it meant a significant ORBAT change, which after augmentation from the other squadrons as well as the TA Yeomanry, saw the Squadron at 120 strong and split into seven Troops (later nine) including SHQ along with the SQMS and the LAD. Once in theatre, the squadron was reinforced by the addition of a multiple of Argyll and Sutherland Highlanders, who, despite the obvious linguistic challenges were immaculate in their drills and discipline, and provided a vital element of continuity having been in Maysan since January.

A Squadron moved into theatre in the first week of April when the PWRR Battle Group commenced a period of acclimatization at Shaiba Logistics Base near Basra, before moving up to Camp Abu Naji near the city of Al Amara. This coincided with the raising of tensions in Najaf and the subsequent deterioration in the security situation in Maysan. This resulted in the battlegroup rapidly shifting from its original role of training and support to the Iraqi Police Service to one of limited war fighting with the local elements of Moqtadar al Sadr's Militia or OMS. The ensuing insurgency campaign saw two major uprisings in April to June and August to September.

The one upside of the increase in hostilities was the welcome decision to issue the Squadron with six CR2. Despite being in pretty poor condition (having been in storage since TELIC) they were very well received, except by the OMS, and ensured that A Squadron's tanks led every major operation. The ability to 'reach out and touch' the opposition in the way that only CR2 could, combined with its ability to withstand multiple RPG hits, gave the troops a considerable advantage in urban and rural operations. The only real threat came from their tendency to stop arbitrarily and refuse to move, usually at a most inconvenient place and time. Fortunately, the LAD under Sergeant Buchan delivered a sterling service, not only in getting the CR2 up from their original dreadful condition into fighting order, but also in towing them home when they broke down, all too often hurried along by the attentions of the local militia.

During the occasional lull in hostilities, A Squadron took the opportunity to shift back into its originally intended role of IPS mentors. This saw us running a number of courses to try and improve the ability of the police to cope with the increasing levels of threats against them. This proved to be a mixture of frustration and satisfaction, with the Iraqis showing themselves to be keen to learn, but constrained by tribal and political loyalties and hampered by a lack of equipment and weapons.

A Challenger 2 of The Queen's Royal Lancers secures a street in the southern city of Amara on 09 May 2004 following overnight clashes between British troops and insurgents. This battle-weary Challenger was one of those resurrected by the QRL REME LAD during Operation Telic 4 as the situation in Southern Iraq deteriorated significantly. (Getty Images)

OPERATION WATERLOO: A SQUADRON, AL AMARAH, 7–12 MAY 2004

The first rise in insurgent activity reached its peak in early May, when it became clear that Moqtadar al Sadr's supporters (known as the OMS, Office of the Martyr Sadr) were attempting to tighten their hold on Al Amarah. Given the obvious threat this presented to coalition forces' authority and control in southern Iraq, it was decided to send a clear message to the OMS by reasserting and maintaining control over the city. Thus Operation Waterloo, which was a PWRR Battlegroup operation, but supported by corps and divisional assets, aimed to achieve this effect by projecting two armoured columns into the city to assist the Iraqi Police in re-establishing law and order.

In the west, the first column led by squadron leader and 1 Troop, entered on what was known as the Red Route and secured the major road junctions with C Company 1 PWRR. Meanwhile, in the east of the city, 4 Troop together with A Company 1 PWRR moved up the Blue Route into a similar series of positions. The focus of the operation was the headquarters of the OMS in the centre of the city, which was known to contain weaponry and ammunition. It had also clearly become a symbol of OMS influence in the area. As the eastern column waited to move to secure this building, the suspected heavy machine gun and mortar positions in the building's compound were neutralized by 40mm cannon fire from a circling AC-130 Spectre gunship from the US Air Force. This proved highly persuasive and allowed the Challenger 2s and Warriors to rumble across the City's main bridge unopposed, taking up position outside the OMS HQ. C Company then cleared the building, supported by a number of others including 3 Troop, A Squadron.

As the morning continued, the level of attacks against the two columns increased, with 4 Troop and A Company in the east receiving the most of the insurgents' attention. Small arms and RPG fire now started to intensify as the task of responding was made more difficult by the tendency of the enemy to use women and children as human shields. A Company also suffered from the bogging of one of its Warrior IFVs in one of the city's ubiquitous open sewers, which took several hours to extract. The closest shave of the morning came when Sergeant Alsop's Four Alpha clipped an anti-tank mine, which had been hidden in a tyre and placed on the road. Thankfully the blast did little real damage to the Challenger 2 or crew.

Meanwhile, 4 Troop leader Captain Yates was facing a separate challenge. Having come across a similar collection of tyres and obstacles to his front, some of the locals then attempted to box his vehicle in with a tractor and flatbed truck to the rear. They failed however to grasp the basic physics of the situation, which gave 65 tons of Challenger 2 right of way, turning the offending vehicles into scrap and putting the owners' no-claims bonuses in jeopardy. Sergeant Alsop in Four Alpha found himself involved in a public order event, with a large crowd of armed and unarmed people of all ages converging on his tank. The vehicle was showered with bricks and then blast and petrol bombs, which set fire to the rubber on the road wheels. Children swarmed over the vehicle, using rocks and hammers to try to smash the optics and episcopes, succeeding only with the driver's vision block. RPGs were also fired at his vehicle, one of which missed, but caused injuries amongst the infantry behind it.

Meanwhile, 3 Troop was busy loading the weaponry found in the OMS building into trucks. This included hundreds of mortar rounds, dozens of RPGs, mines and small arms, in addition to several anti-tank missiles. They also helped recover weapons from an alternative HQ in the local library, including a 30mm automatic grenade launcher. As the insurgent activity across the city diminished, the Iraqi Police now started to assert their control on the street. This allowed the troops to resupply, rest and eventually return to camp after 36 hours on task. Whilst the battlegroup had sustained six casualties during the operation, none were fatal. The same could not be said for the militia, which added many dead and injured to their loss of weapons and equipment.

The US Marines had already identified the increasing propensity of what they term the 'three-block war', which sees military forces engaging in the full spectrum of activities, from humanitarian aid to peacekeeping and war fighting, but within a highly limited timescale and area of operations. Operation Waterloo was an introduction to the reality of this concept, which in turn set the trend for the rest of Operation Telic 4.

THE 'DANNY BOY' ENGAGEMENT: A SQUADRON, AL AMARAH, 16 MAY 2004

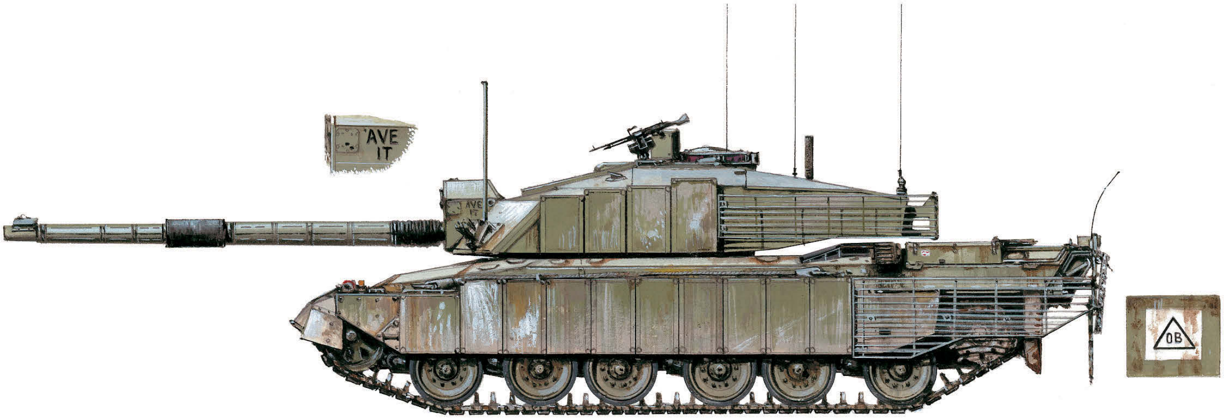
On 16 May 2004, a Rover Patrol of the Argyll and Sutherland Highlanders (A&SH) heading north on Route 6, connecting Basra and Al Amarah, was involved in a planned and coordinated multi-weapon ambush. This attack fixed them to the south of an Iraqi Police permanent vehicle check point, known as 'Danny Boy', some 10 miles south of Al Amarah. The battlegroup's Warrior QRF was immediately tasked to assist with support provided by Challenger 2s from 1st Troop, commanded by the squadron leader and Corporal Newton. Upon arrival the troop went straight into action, suppressing several militia depth positions with 7.62mm chain gun, while the dismounted infantry assaulted the closer positions.

Corporal Newton identified a truck reinforcing a position with more militia and, along with the Warriors, led the attempt to neutralize it. When this proved ineffective, he authorized his gunner Trooper Jones to engage with a single round of 120mm HESH. This proved decisive, not only in neutralizing the position itself, but also making it clear to the other insurgents that they were heavily outgunned. This single round then permitted the A&SH patrol to extract from the area and move back to the safety of Camp Abu Naji. Meanwhile, Captain Strong had moved to assist the two Warriors south of Danny Boy, one of which was suffering mechanical and weapon failure. With militiamen attempting to outflank the Warriors, Captain Strong's tank added the weight of its own 7.62mm fire to the infantry's 30mm and 5.56mm fire. As the militia to their front were beaten back, the Challenger 2 was attacked from the rear by three RPGs, but once again the threat was swiftly neutralized thanks to accurate target indications by the operator, Corporal Bishop.

Shortly after, the area fell silent as the militia retreated back to Majar al Kabir and, as darkness fell, the scene was illuminated only by the blazing fields and the lights of the ambulances arriving to collect the enemy wounded. The result of the engagement was over 70 enemy killed with only two slightly wounded amongst the A&SH patrol. Much greater however, was the message that this sent to the insurgents from Majar al Kabir and throughout the province, that attacks on Coalition forces would be met with overwhelming force.

OPERATION HAMMERSMITH: A SQUADRON IN AL AMARAH, APRIL–SEPTEMBER 2004

CIMIC House, the former residence of the Maysan Provincial Governor, sits on the confluence of the river Tigris and holds a prominent geographical point in the centre of the city of Al Amarah. It is for this reason that the Coalition Provincial Authority (CPA) and Civil-Military Cooperation (CIMIC) Teams chose to use it as their base in



CHALLENGER 2, A SQUADRON, THE ROYAL DRAGOON GUARDS, OPERATION TELIC 5, MAJAR AL KABIR, SOUTHERN IRAQ, 28 DECEMBER 2004

Like Operations Palatine in Bosnia and Agricola in Kosovo, Operation Telic has become another longstanding commitment for the British Army. An armoured regiment is deployed for a six-month roulement in support of the British forces in southern Iraq. This Challenger 2 belongs to A Squadron, The Royal Dragoon Guards, and is the mount of the squadron leader, Major Dan Rawlins. Accordingly, the tank's callsign is Zero Bravo displayed on the convoy distance plate on the rear hull. The crew comprises Corporal 'Skippy' Greenwood as loader/operator, Trooper 'Spence' Spencer as gunner and Trooper 'Rushy' Rushworth as driver. The tank is depicted during Operation Fenners in the town of Majar al Kabir over the Christmas period of 2004. Known as 'MAK' to British troops, Majar Al Kabir was one of the most lawless towns of southern Iraq and was the scene of the killing of six Royal Military Police soldiers in June 2003. During the regime of Saddam Hussein, it required 30,000 troops, scores of helicopter gunships and hundreds of AFVs to suppress the Maysan Province. As part of the Welsh Guards Battlegroup during Operation Fenners, A Squadron comprised six Challenger 2 tanks together with 14 Warrior IFVs of Burma Company, 1st Battalion, The Duke of Wellington's Regiment. As crews are rotated constantly, the tanks do not carry specific callsigns on the turret. The VRN of Zero Bravo is DS21AA, applied on the right rear hull plate above the light cluster together with a small Union flag above. The tanks of A Squadron – The Blue Horse – in Iraq feature names beginning with the letter A and Zero Bravo is named 'AVE IT, painted on the sides of the TIS barbette. The Challenger 2 tanks in Iraq are no longer painted in desert camouflage and dust mitigation skirts are not replaced once damaged beyond repair. The tank features the DL2F armour configuration and further survivability enhancements are being incorporated but details remain classified, apart from the 'cheesecutter' to protect the crew from overhanging wires and boobytraps.

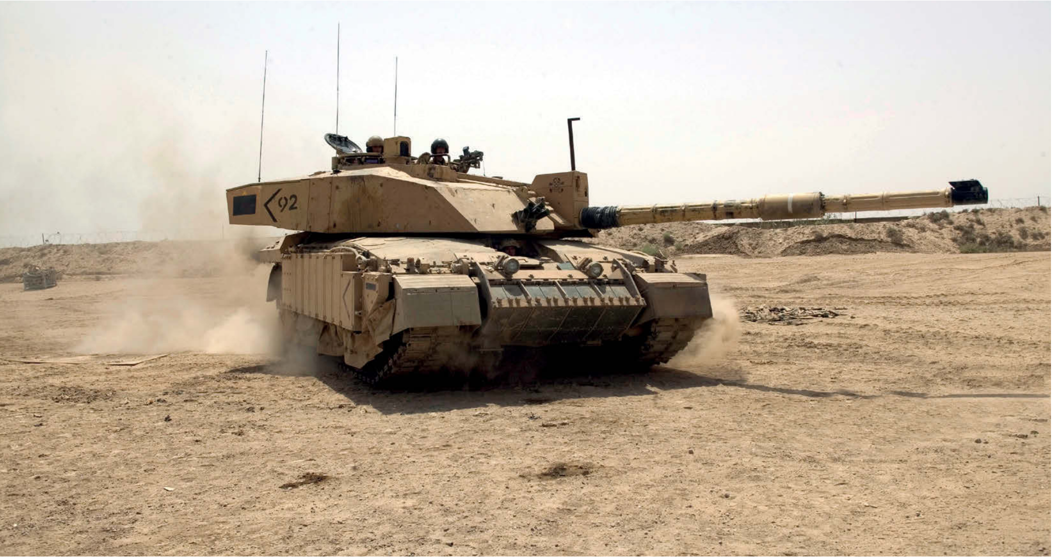
Iraqi youths gather around a Challenger 2 TES of A Squadron The Royal Dragoon Guards parked in the center of al-Gharm, 15 kms north of Basra, on 15 November 2004 during Operation Telic 5 when the first Challenger 2s with supplementary armour protection and other enhancements were deployed from UK. (Getty Images)

A Challenger 2 TES stands by for deployment at The Royal Dragoon Guards base in Shuaiba near Basra on 31 January 2005. The flags are flying at half mast after a Royal Air Force C-130 Hercules crashed north of Baghdad, killing 15 crew and passengers. (Getty Images)

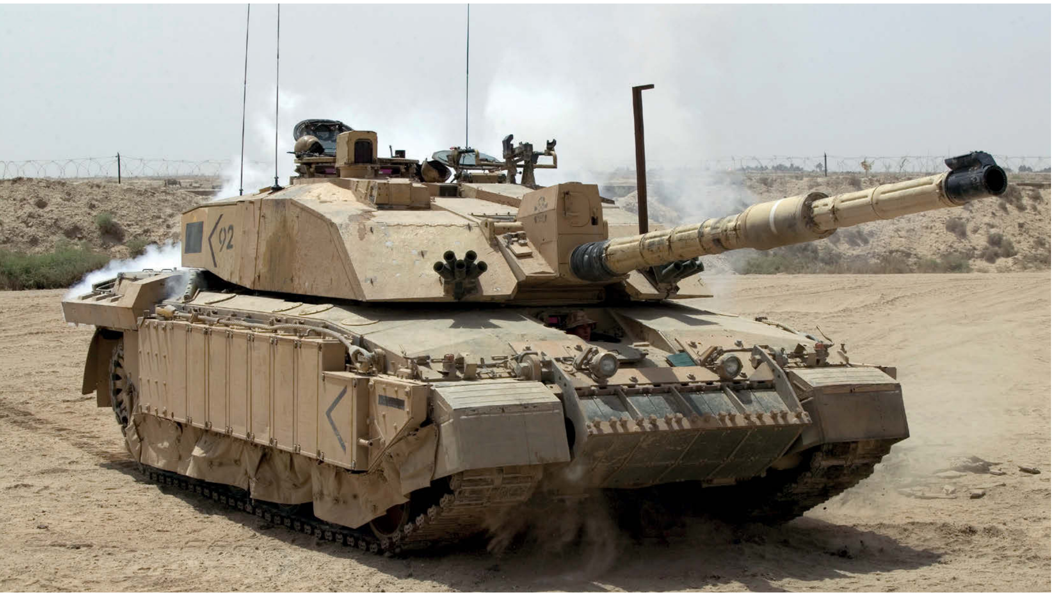
town. With tensions in the area increasing at the beginning of April 2004, Y Company 1 PWRR was deployed to the location in order to provide security and protection for the teams, as well as providing the battlegroup with a foothold in town.

With tensions steadily increasing throughout late July, early August saw a more intense period of attacks against CIMIC House. Without wishing to inflame the situation further by deploying armour, the brigade CO ordered Y Company to conduct an aggressive positional defence of CIMIC House, with 1st, 4th and 6th Troops all seeing action. As a taste of the intensity of the period, between 5 and 19 August there were 495 mortar attacks, 37 RPG attacks, seven incoming 107mm rockets and numerous small-arms engagements. During one night of particularly intense activity, 4th found themselves pinned on a school rooftop, with the ensuing firefight seeing the Troop expending over 1,000 rounds of ammunition and allowing Sergeant Alsop to finally get to play with his 40mm Underslung Grenade Launcher. On 19 August a relief column made up of A Squadron's Challenger 2s, C Company Warriors and the Royal Welch Fusiliers fought its way into town to relieve CIMIC House as part of OP Hammersmith. This was not a moment too late, as both rations and water were running low, the generators and water tanks were peppered from direct hits and more critically the nerves of everybody present were beginning to wear thin. Finally, 2nd Troop spent a three-week extended stay in CIMIC House while the battlegroup planned for the withdrawal from town as part of the plan to hand back CIMIC House to the Iraqi authorities.

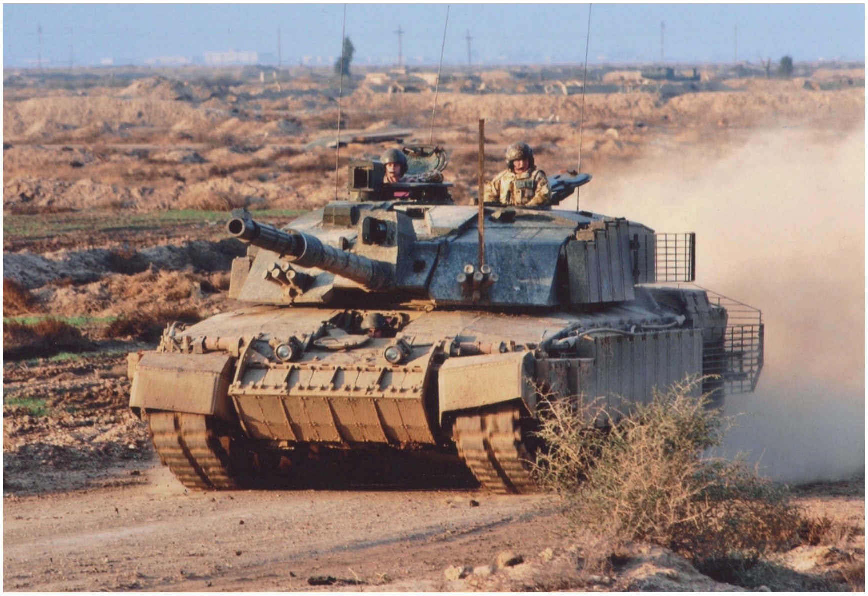
Early August saw the second major 'spike' in hostilities and resulted in the Iraqi Police once again losing control in Al Amarah. Therefore, as with Operation Waterloo, the aim of Operation Hammersmith was to loosen the OMS hold over the city. The intensifying of attacks on the battlegroup's city outpost of CIMIC House made this all the more imperative; accurate incoming mortar fire was now a nightly occurrence, and casualties mounted.



As tensions in Basra and Southern Iraq rose during the early part of Operation Telic 4 in 2004, it was decided to resurrect some of the Challenger 2 MBTs still in storage at Um Qasar waiting to be back loaded to UK. Despite being in a poor condition, the Light Aid Detachment soon had half a dozen up and running and they became the ninth troop in A Squadron Queen's Royal Lancers leading repeated raids into Basra and elsewhere.



Once again, A Squadron's tanks led a column of Warriors into the city late on the evening of 10 August, with Zero Bravo and the lead Warriors coming under RPG fire as they entered the outskirts. Pressing on, the columns split and finally moved into position around the Al Dayya district of the city, which had become the base for the militia's activities. With the intent of causing some attrition amongst the militia, the ethos of the operation was clearly 'come on if you're hard enough' and the mixture of tanks, Warriors, dismounted infantry and circling Spectre gunships meant that the British were. Once in position, several engagements took place, including a demonstration in the use of 120mm squash-head practice rounds as a way of removing well-defended enemy with minimal collateral damage. The accompanying Warriors of B Company 1st Black Watch triggered a massive roadside bomb, which thankfully left them shaken but not stirred.

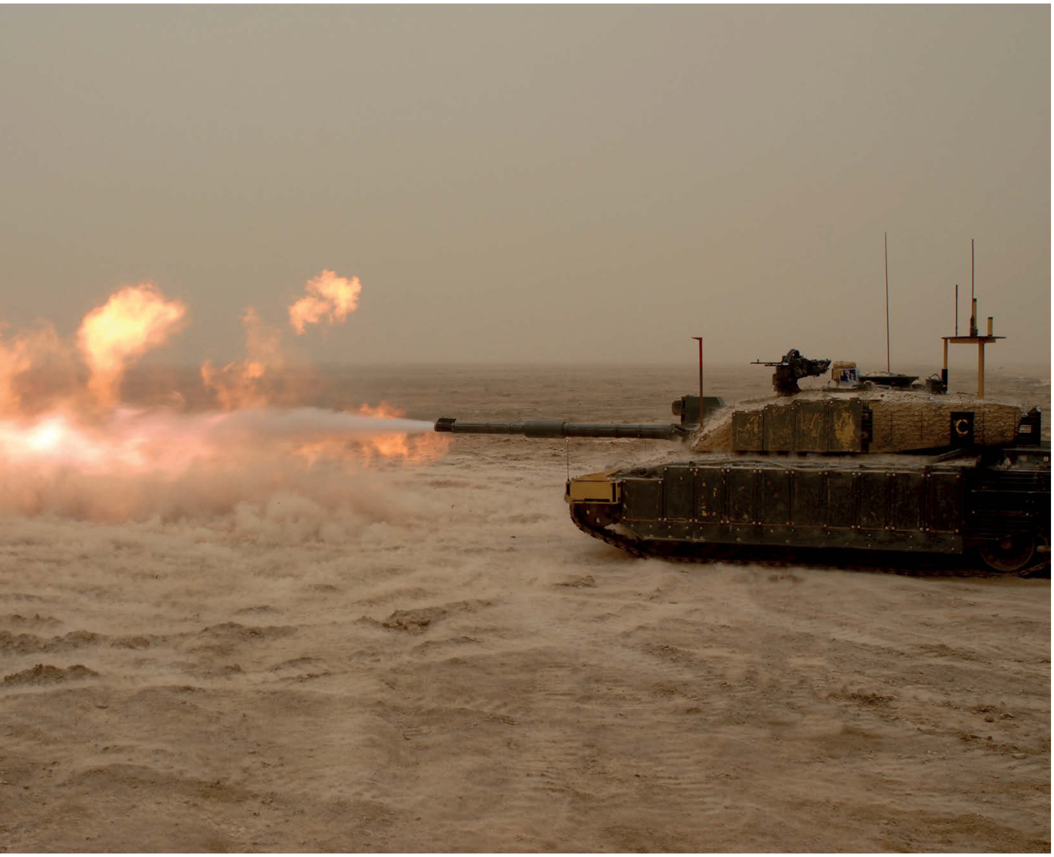


Callsign Five Two thunders down the road in a cloud of dust as it approaches Camp Abu Naji following a night patrol to deter infiltration by insurgents around the outskirts of Al Amarah – 'Show Me The Way To Al Amarah' – on New Year's Day 2005. During Operation Telic 5, The Royal Dragoon Guards fielded two squadrons of Challenger 2 MBTs – A Squadron, 'The Blue Horse', and C Squadron, 'The Black Dragoons'. Each squadron had two troops with three tanks each and one for the squadron commander. A further two MBTs served with Regimental Headquarters giving a total of 16 tanks with the remainder held in reserve. In A Squadron, RDG, the tanks were employed by 3rd and 5th Troops while 1st and 2nd Troops were equipped with Land Rovers, both armoured and unarmoured, while 4th Troop were part of the regiment's reconnaissance troop. Accordingly, callsign Five Two is the troop corporal's tank of 5th Troop, A Squadron, with Corporal 'Dinger' Bell in command, Lance Corporal Danny Teall as loader/operator, Trooper 'Jono' Johnson as driver and Trooper 'Austin' Powers as gunner. One of the standard modifications in Iraq is the addition of a metal picket stanchion 'cheesecutter' welded to the left front smoke-grenade discharger to protect the turret crew from overhead wires.

Having neutralized the threat in the estate, the columns were tasked to clear the main routes leading out of the city. With numerous RPG ambush teams now lying in wait this was obviously going to be entertaining. However, once again the air support proved decisive, with Spectre fire missions going in as little as 100m to their front and flanks. As the column proceeded, the incoming RPGs were met with outgoing chain gunfire from the tanks and Warriors (with Captain Jeffrey's tank disappearing into a cloud of its own smoke as an RPG hit ignited its grenade dischargers) and slowly but surely the attacks diminished. Moving to the major junctions in the city, the battlegroup consolidated in order to provide the safe environment necessary to allow the Iraqi Police to re-establish security in the city.

Over the next few nights, patrols into the city continued not only to re-supply CIMIC House but also to neutralize the ever-persistent mortar teams. During one such patrol Corporal Nash and his crew were providing escort cover for a group of four Warriors when they came under sustained RPG and small arms fire. Corporal Nash's tank sustained two direct RPG hits, the first of which destroyed his driver's sights, forcing him to guide his driver using the TOGS, the second round damaging one of his road wheels. As they approached their final task location they received a further RPG attack that destroyed the Tl sight, effectively blinding the tank. Thankfully, the use of a handheld image intensifying monocular sight meant that, together with friendly mortar illumination, he was able to identify and engage the ambush teams, in addition to guiding his driver. This continued for an hour until battlegroup HQ decided that they had pushed their luck about as far as was advisable and they were ordered to head home, pausing only to dismount and replace the various bits of the vehicle that were hanging off.

The stick of further operations in the city (which included the dropping of a 500lb bomb on top of a mortar team) combined with the carrot of civil and economic reconstruction programs, meant that, by September, a local peace deal had been agreed and the battlegroup was in a position whereby it could now hand CIMIC House back to the Iraqi authorities with its pride intact. The Challenger 2 was to be an integral part of every subsequent battlegroup during Operation Telic.



A Challenger 2 of B Squadron The Royal Dragoon Guards undertakes gunnery training near Basra during Operation Telic 11 in April 2008. The tank is in full Theatre Entry Standard with Dorchester Level 2F armour package, ECM suite and Remote Weapon Station. This was the final configuration of Challenger 2 in Iraq as military operations were completed in 2009 and the withdrawal of the MBTs followed soon thereafter.

BOTTOM As the first armoured regiment to be equipped with Challenger 2, crewmen of the Royal Scots Dragoon Guards raise their Regimental flag to mark their final days of manning the British Army's ultimate MBT.

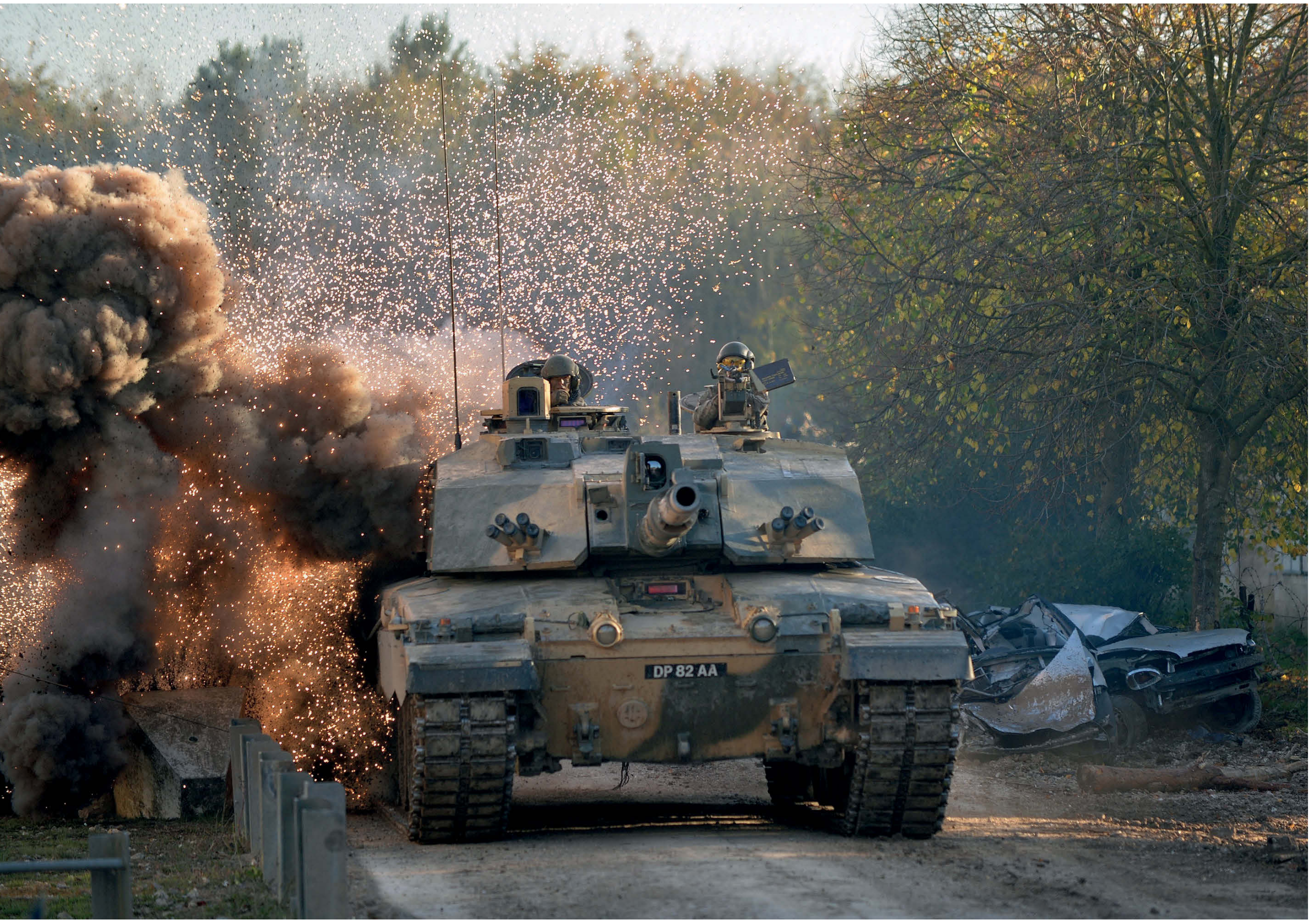
POSTSCRIPT: CHARGE OF THE KNIGHTS

During the summer of 2007, all the armoured squadrons of The Royal Dragoon Guards undertook an Exercise Medicine Man at BATUS in Canada. Their level of commendable professionalism was duly noted in the report by Commander BATUS: 'The RDG Battlegroup [BG] has achieved a very high standard of training. It is recommended that this BG is fit to be Commander 4 Mechanised Brigade's BG of first choice for agile/high tempo tasks. The BG's strong points are agility and tempo, offensive spirit, Combined Arms Effects and Command and Control.' And so it came to pass during November 2007 when the regiment deployed with all its constituent elements within 4 Mechanised Brigade to Iraq for Operation Telic 11. The Battlegroup Headquarters, Prince of Wales's Squadron, A Squadron and C Squadron (along with Burma Company, 1st Battalion, The Duke of Lancaster's Regiment), formed the Regimental Battlegroup. B Squadron was part of the Scots Guards Battlegroup while D Squadron was grouped with 1st Battalion, The Royal Regiment of Scotland, (Royal Scots Borderers) Mentoring Battlegroup.

Known as The Black Horse, B Squadron was equipped with Challenger 2 MBTs and was attached to the Scots Guards Battlegroup (SG BG), commanded by Lt Col William Swinton. He fully recognized the value of the close integration of Challenger tanks alongside his Warriors of Left Flank. The blend of firepower and armoured protection offered by Challenger 2 complemented the intimate support provided by the Warriors and their dismounted soldiers, and was particularly relevant when operating in the complex urban environment of Basra. This was never more so than when operating at night, when Black Horse crews could maximize Challenger 2's outstanding night-fighting capability to close with and kill the enemy. During Operation Telic 10, the Challenger 2 MBTs of The Royal Scots Dragoon Guards had been under-utilized for a variety of reasons, with the result that the Warrior IFVs and other AFVs had suffered from a high incidence of IED attack. IEDs were to remain the main threat to AFVs but they were less successful against Challenger. For The Royal Dragoon Guards, Operation Telic 11 proved to be significantly more mobile and 'kinetic', in the jargon of the time, than the regiment's previous deployment to Iraq on Operation Telic 5.

The primary roles of British forces at the time were to conduct operations in conjunction with Iraqi Security Forces, to monitor and influence activity in Basra, as well as undertaking security operations along the Iranian border. The battle groups were stationed at the Contingent Operating Base or COB at Basra air station, which was constantly under indirect fire from mortars and rockets that caused the majority of casualties. Accordingly, much effort was devoted with Operation Dagger to unmasking firing sites to reduce such hazards. Only B Squadron was deployed in Challenger 2 MBTs, with the other squadrons manning Warrior and Bulldog IFVs after just a month of training and qualification. The RDG Battlegroup, commanded by Lt Col Tim Hyams, conducted ground and aviation manoeuvre operations throughout Maysaan and Basra provinces to deter and deny the infiltration of arms and insurgents from Iran. These operations saw the BG become the first British troops to enter Basra since the withdrawal of 1 Mechanised Brigade the year before. They involved close combat with the enemy and opposed river crossings. The Scots Guards Battlegroup was tasked as the Strike Battle Group for offensive operations as well as being the COB Quick Reaction Force.

Among the first AFVs of SG BG to be attacked was Bravo Four One, the mount of the troop sergeant of 4th Troop, Sergeant Antony 'Bassy' Bass. His Challenger was

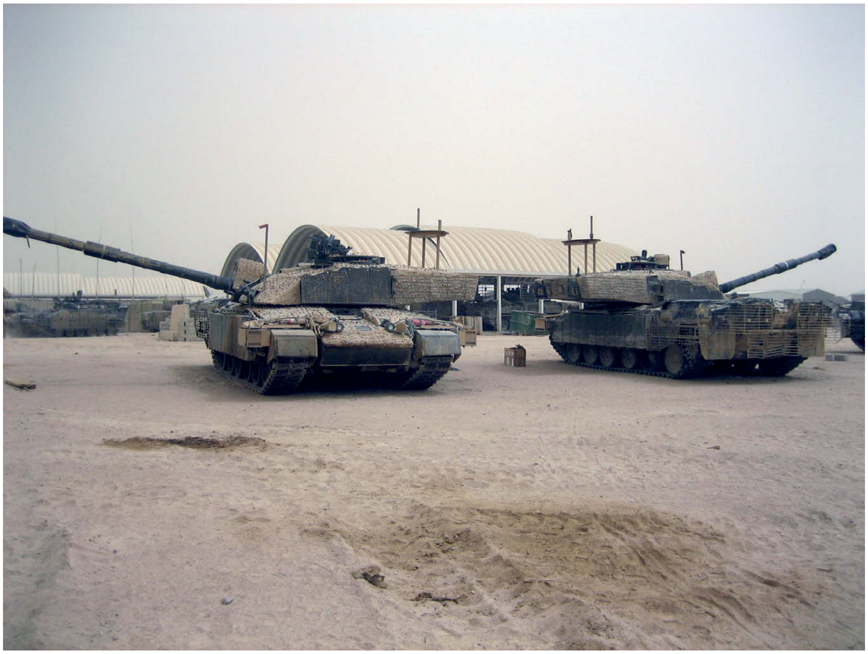


A Challenger 2 of The King's Royal Hussars is blasted by a mock IED during a FIBUA exercise in conjunction with the Royal Welsh at Copehill Down. The Improvised Explosive Device and its more destructive partner, the Explosively Formed Projectile or EFP, were the greatest dangers to MBTs and IFVs during the prolonged insurgency in Iraq.

blasted by an IED that was a 35kg EFP (Explosively Formed Penetrator). Fortunately, it went off towards the rear of the tank so the main slug missed the vehicle, but the blast came in through the operator's hatch – shaking up the turret crew, but causing no serious injuries. As Sergeant Bass recalled later: 'With a combat weight of over 72 tonnes, the IED did not even rock the vehicle so Kyle down in his driver's cab did not notice the explosion and we were able to drive away. From that point on the crews' confidence soared and everyone was demanding to go out on patrol. The confidence we gained from that explosion set the pace for all our subsequent operations, knowing we could survive anything the enemy could throw at us.'

It was a timely event as operational intensity grew, culminating in late March when the Iraqi Army launched Sault al-Fursan or Operation Charge of the Knights to expel the Mahdi Army militias from the city of Basra. The operation began on 24 March and was the largest undertaken by the Iraqi Army to date, involving some 14,000 troops and 16,000 policemen, including an armoured and a mechanized brigade of the 9th Division. Coalition support was restricted to artillery and airpower against precision targets. Within days, the offensive stalled and the decision was taken to commit British ground troops with Scots Guards Battlegroup to the fore. In the van was B Squadron, primarily acting as the first line of defence against IEDs, but also providing intimate fire support to infantry and Special Forces teams locating specific targets in Basra. On 4 April 2008, 1st Troop, B Squadron, led a column of the Strike Battle Group into the IED-infested Basra suburb of Hayaniya. Sergeant Chris Richards was in command of 1st Troop on this occasion and recalls:

> We had operated once before in this area south of Basra and then we had come under fire from mortars, small arms and IEDs. But now it was so heavily defended with IEDs they needed tanks to take us up to the front door. At the time my troop leader was on R&R so I volunteered to lead the troop. We were told that the operation was in a particular area and we want the tanks to lead. Now my troop corporal at the time was Corporal Mark O'Fee and usually he led wherever we went, with me as the troop sergeant at the back. This particular day I said, 'Mark you can go at the back this time and I will lead in'. There were threat warnings, but then there always were when out on the ground – you have to expect it. So, when we were going in it came over the radio that there was an increased warning of IEDs and sniper threat, so we went in fully buttoned up and a bit more cautious. It was all planned out where we were going to go, where we were going to position each individual tank, and where my final position was going to be with the attached infantry who actually were going to go in and do the job into the buildings of interest.
>
> At the time I had permission to clear roadblocks with whatever means necessary, which meant one-twenty mil. I soon came across a small roadblock of a sizeable pile of rocks. I assessed we could get the tank around that from about 400 metres since the optics and sighting systems on Challenger are superb. As we approached it there was one almighty bang. The first thing that goes through your mind – stop the vehicle straight away and just make sure the crew were fine, that being the most important point of all. Everyone was fine – gleaming. There was no discernible damage to the vehicle, we still had all systems up, so we set off again but within a couple of metres there was another bang and we went through the same process. We then came under small-arms fire. The gunner saw some hot spots on the road through TI and more obstacles so we responded with coax but nothing exploded, so I said 'It's clear move

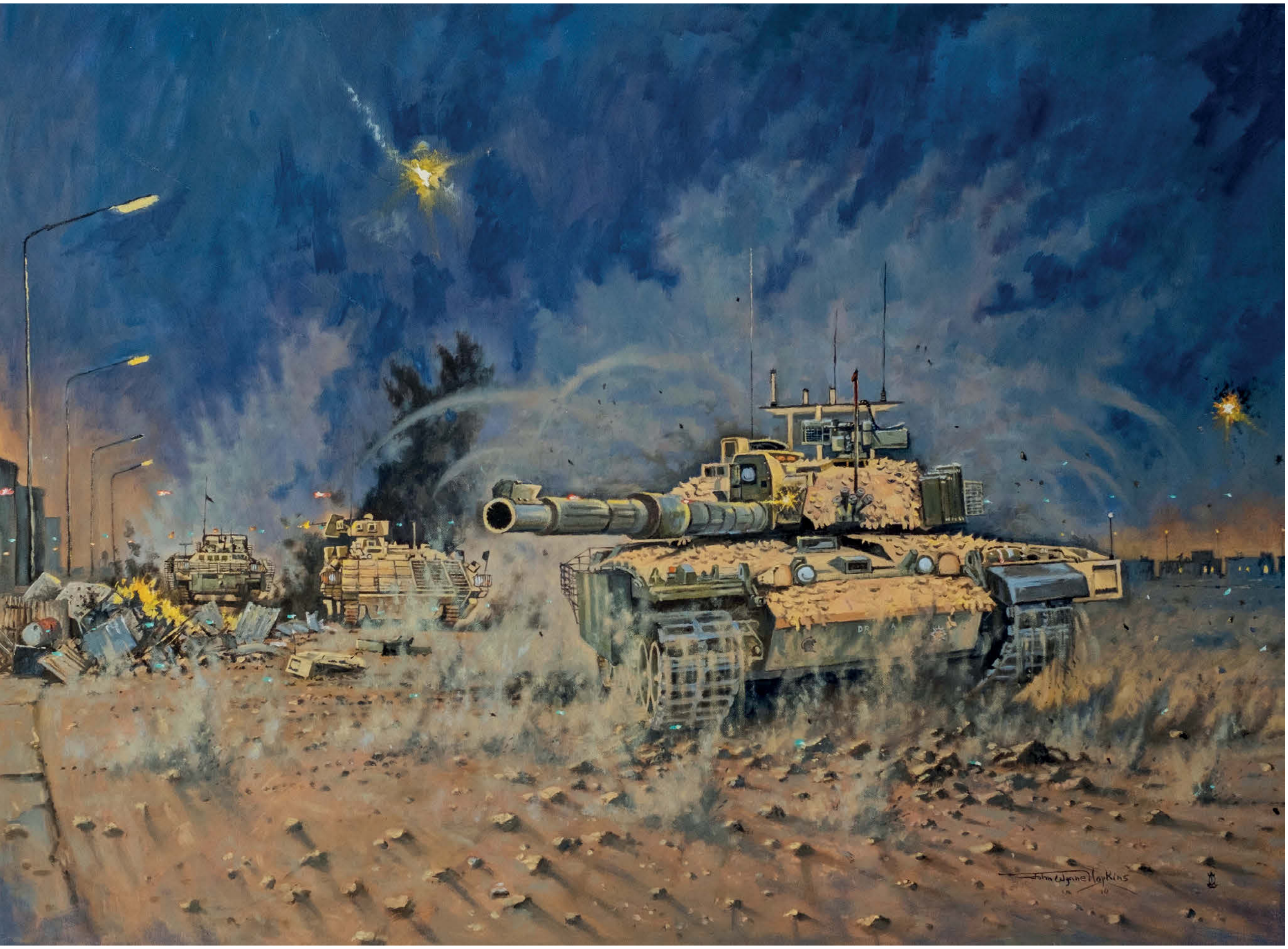


A pair of Challenger 2 MBTs of 1st Troop, B Squadron, The Royal Dragoon Guards, stand ready at the Basra Contingency Operating Base as part of the Quick Reaction Force in February 2008. As The Black Horse Squadron, B Squadron comprised four troops, each of four tanks, with a further two in Squadron Headquarters to make 18 in all. The main role of the tanks was as a show of force through Ground Domination Activity or GDA patrols. These involved picketing routes, with daily patrolling and constant overwatch with tanks placed at strategic points, using their outstanding optical sights to observe the behaviour of insurgents at considerable distances – an aspect much feared by the militia. The Challenger 2 on the left is fitted with a Remote Weapon System above the loader's position. Being in short supply at the time, the RWS was usually provided first to the troop sergeant to allow him to undertake surveillance tasks while the troop leader was freed to command his various assets on patrol. The lengths of patrols varied depending on the situation but were commonly up to 20km in duration, and usually involved two troops.

on!' We pushed on and further up the road with the Warriors behind us [Left Flank Scots Guards].

I then saw a larger roadblock with a lot of scrap metal on the road that we drove over – no drama. But there was a suspicious vehicle blocking the road and so I radioed the situation higher up and with time pressing I was given authority to engage with main armament. I took the decision not to use the one-twenty because of the close proximity of houses nearby. If the car was packed with explosives then a 120-mil HESH round would have caused catastrophic damage and probably serious civilian casualties. Instead I pushed on and then we met the biggest of the five IEDs we encountered. It was huge. Again my priority was my crew and thankfully we were all OK. The vehicle took some damage but we could still move and still had all our systems. We could drive, we could see with our sighting systems, we could still fire. I didn't lock down my hatch properly so I could look out directly, so when the blast went off it blew open the hatch and with all the dust in my eyes I lost sight for a couple of minutes, even though I had the blast goggles on. Then almost simultaneously another two IEDs went off directly behind me which both hit my tank and the Warrior following. Again there was no discernible damage but that meant five IEDs had exploded around the tank in about five minutes. We assumed they were command-

The action of the Challenger 2 of Sergeant Chris Richards MC during Operation Charge of the Knights is graphically depicted in a painting by John Wynne Hopkins, with the Chobham armour side plate detached by the IED explosion: all such classified equipment had to be recovered after the battle and photographs of the Challenger 2 and any combat damage were strictly forbidden. (Courtesy of The Royal Dragoon Guards)



> detonated as we were fully fitted with electronic countermeasures. I then pushed on another hundred metres to the position I had to be in. The boys from Left Flank went in and did the job and it was then back to the COB. I was then to be the last vehicle in the packet. So we reversed out and turned round and headed back to the COB. It was then getting light and by the time we got back to the COB it was daylight. I then jumped off the vehicle to assess the damage. The side armour panels had absorbed the blast but one of them was missing so the rest of the troop went out again to collect it and any other stuff that had been blown off the tank. It was repaired in-theatre within the week and I was soon back on it. No harm done. Anyone else in the regiment would have done what I did. I don't think I did anything special but I was awarded the Military Cross.

Undoubtedly, B Squadron had reaffirmed the relevance of heavy armour in counter-insurgency operations. At the conclusion of Telic 11, the Commanding Officer of the Scots Guards stated, 'Whenever my Battlegroup deployed from the COB, it was a member of The Black Horse who led the column. Every member of my Battalion acknowledges and appreciates that.' Operation Telic 11 was the first occasion that the regiment had fired their tank guns in anger since the Korean War. Again, a single tank action similar to that undertaken by Black Bess on the Hook proved decisive and the commander was awarded a Military Cross. In the case of Sergeant Chris Richards, the medal was granted for the restraint that was shown by him in the minimum use of firepower in an urban situation, just as much as for the gallantry shown by the crew of the Challenger 2. The Charge of the Knights was the last major armoured operation of the Iraq War undertaken by the British Army.

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This volume of British Battle Tanks is the final book in a four-part series that traces the design, development and employment of British tanks from their introduction in 1916 until 2016, marking one hundred years of their use in combat. In a work of this scope, many people have given their time and knowledge to address this fascinating subject to whom I extend my comprehensive thanks. Many of them provided photographs that have added immensely to the presentation of the book. Similarly, some photographs are courtesy of the Ministry of Defence under the Government Open Licence Agreement and also of the Israel Government Press Office. Of the many individuals, I am deeply grateful to the following. First and foremost, I am most obliged to Maj. Gen. Patrick Cordingley and Maj. Gen. Sir Laurence New for their enlightening insights into the extraordinary complexities of tank procurement and practice. By the same token, I am indebted to Lt. Col. Richard Taylor and Maj. Graeme Green for their particular expertise on tank fire control systems. For the sake of brevity, all ranks and post-nominals of the following persons have been omitted.

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FOLLOWING PAGES
The tank first saw combat in 1916 to address the particular circumstances of the Western Front. However, the need for an Armoured Fighting Vehicle, capable of negotiating broken terrain and bringing direct fire to bear against a mobile or entrenched enemy, remains as necessary as ever, even after some 100 years of warfare.

12D
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12C
12C

INDEX

Page numbers in **bold** refer to illustration captions

1st Armoured Division (India) **81**, 81–84, **82**
1st Armoured Regiment (Australia) **85**, 85–88, **86**
1st Battalion The Duke of Wellington's Regiment 19
1st Battalion The Staffordshire Regiment 208–225
1st Royal Tank Regiment **7**, 18–19, **29**, **51**, **69**, 74, 75, 137, **149**, **151**, **199**, **232**, 243, **251**
2nd Royal Tank Regiment **162**, **170**, **185**, 197, 198, **230**, 243, 264–290, **265**, **266**, **267**, **268**, **269**, **270**
4th Armoured Brigade **163**, 237
4th Royal Tank Regiment **7**, **23**, **43**, **74**, **173**
4th/7th Royal Dragoon Guards **135**
5 Armoured Engineer Squadron **253**, **260**
5th Royal Inniskilling Dragoon Guards 10–18, **12**, 24, 50, **71**, 71–74, **129**, **139**, **140**
5th Royal Tank Regiment 24, 137
6th Royal Tank Regiment **75**, 75–80, **76**, **77**, **78**, **79**, 90–91
7th Armoured Brigade 237
8th King's Royal Irish Hussars 10, **66**, 67, **67**, **68**, 68–71
8th Royal Tank Regiment **20**
11th (Prince Albert's Own) Hussars **146**
14th/20th King's Hussars **208**, **210**, 211–225, **213**
16th Independent Armoured Brigade (India) **84**
16th/5th Lancers **47**
17th/21st Lancers **146**, **149**, 196, **220**
23 Engineer Regiment **167**
26th Armoured Engineer Regiment **53**
32nd Armoured Engineer Regiment **54**, 168, **171**
100 Hours War (1956) 90–91

Abrams tanks 175, 184, 205, 228
Afghanistan **255**, **260**
air conditioning systems 238
Al Amarah (2004) 280
Al Sorour, Colonel Salem Masoud 160
Allbutt, Corporal Steve 269
Allen, Major J. 79
ammunition
  AP (Armour-Piercing) 129
  APDS (Armour-Piercing Discarding Sabot) **20**, 26, 63, 183
  APFSDS (Armour-Piercing Fin-Stabilized Discarding Sabot) 8, 174, 183, **264**
  HEAT (High-Explosive Anti-Tank) 32, 61, 116, **122**, 129, 174, 175
  HESH (High Explosive Squash Head) **7**, 8, 34, **130**, 183, **264**
  HVAP (High-Velocity Armour-Piercing) 129
  L27A1 depleted uranium rounds 245
AMX Leclerc tanks 231
AMX-30 tanks 152–153
AMX-50 tanks **32**, 32–33
Anstice, Lieutenant Michael 10–11, 12, 13–14, **14**, 15, 16, 17, 18
anti-tank guns 116, 174
  3.5-inch rocket launchers 16
  88mm anti-tank guns 21
  Sagger anti-tank missiles 111
AOR (Area of Operations) 260
AP (Armour-Piercing) ammunition 129

APDS (Armour Piercing Discarding Sabot) ammunition **20**, 26, 63, 183
APFSDS (Armour-Piercing Fin-Stabilized Discarding Sabot) ammunition 8, 174, 183, **264**
Arab-Israeli War (1967) 174
Arbuthnott, Lieutenant David 13
Area of Operations (AOR) 260
Arieli, Captain Uzi 101
armament
  .30-inch calibre Browning machine guns **48**
  .50-calibre ranging guns 49, **117**, **119**, 120, 136, 190
  3-pdr guns 114
  7.62mm machine guns 65, 126, **138**, **139**, 183, 245–246
  17-pdr guns 24
  20mm Polsten cannon **20**, 21, 22–23
  20-pdr guns 10, **14**, **20**, **23**, 24, **25**, **26**, 27–28, 34
  75mm guns 19
  76.2mm 17-pdr guns 20–21
  105mm guns 7, **23**, 26, 47, **48**, 50, 116, 119, **119**, 122, 124, 125
  120mm guns 4, 8, **40**, 126, **132**, 136, **145**, 178–179, 183, **199**, 229, **229**, 244–245
  Besa machine guns **21**, 24, 28, **28**, 44
  Computerized Sighting System (CSS) 183
  Fighting Vehicle Gun Control Equipment (FVGCE) 147
  Fire-Control Systems (FCS) 186–192
  grenade launchers 65
  Gun Control Equipment (GCE) 187–188
  Improved Fire Control Systems (IFCS) **117**, 126, **145**, **147**, 191–192
  L3A2 Browning machine guns **25**
  L11A5 rifled guns 8
  linkages 189–190
  Quadrant Fire Control (QFC) 189
  Tank Laser Sight (TLS) 147
armour **23**, 36–37, **39**, 134
  Chobham armour 7, 8, **54**, 125, **125**, **156**, 166, 175, **209**, **212**, 249, 261
  Dorchester armour **241**, 249, 261
  Explosive Reactive Armour (ERA) 59–61, **209**, 249
  Stillbrew passive armour **150**
Armour-Piercing Discarding Sabot ammunition (APDS) **20**, 26, 63, 183
Armour-Piercing Fin-Stabilized Discarding Sabot (APFSDS) ammunition 8, 174, 183, **264**
Askarov, Major Shmuel 99, 100, 101, 102–103, 105, 111, 113
Assal Uttar, Battle of (1965) 82
Avika, Captain Uri 101
Az Zubayr, assault on (2003) 265–269, **270**

Bagnall-Wild, Major Ralph 8
Baird, Sergeant David 273
Basantar, Battle of (1971) **84**
Basra, battle for (2003) 269–277
Bass, Sergeant Antony 'Bassy' 286–287
Beach, General Sir Hugh 8
Beckman, Lieutenant Oded 101
Beer, Major Nigel 224–225
Ben-Gal, Colonel Avigdor 'Yanosh' 98, 99, 102, 108, 110, 111–112
Ben-Shoham, Colonel Yitzhak 99–100, 102, 104, 106, 109–110, 111
Berlin Blockade (1948-49) 66
Berlin Brigade **148**
Berlin Wall **43**
Besa machine guns **21**, 24, 28, **28**, 44
Biggart, Major Jonathan 273
Binns, Brigadier Graham 270
Black Watch, The 10–18, 273, 283
Bogatyrev, Major General Vladimir 159
Bosnia (1996) **182**, **191**, **194**, **204**, **205**
Brannigan, Major Chris 276
Brims, Major General Robin 273
Brindley, Trooper 11, 16
Britton, Major Andrew 266, 268
Buxton, Lieutenant Tim 217, 219

- Canadian Army Trophy (1987) 196–201, 202–203
- Carden, Sir John Valentine 114, 115
- Centurion tanks 4, **9**, **28**, **42**, **43**, 115, **291**
  - armament 10, **14**, **20**, 21, **21**, 22–23, **23**, 24, **25**, **26**, 27–29, **28**, 34, 44, 47, **48**, 49–50, 65
  - deployment 7, 10–19, 46, **51**, **52**, **53**, 54, **54**, 56, **57**, 57–61, 66–113
  - design and development 19–26
  - evolution 44–50
  - exports 7, **42**, 44–47, **55**, 57–65
  - Fire-Control System (FCS) 188, 189–190
  - insignia **23**, **29**, **43**, **47**, **51**, **77**, **81**, **85**, **109**
  - paint schemes **23**, **29**, **43**, **46**, **47**, **51**, **53**, **77**, **81**, **85**, **86**
  - special-purpose variants 50–57
  - technical description 26–30
  - upgrades 57–65, 88–89
- Chaffee light tanks 31
- Challenger 1 tanks 7, **9**
  - armament 8, 178–179, 183, **199**
  - armour 175, 179, 184, **209**, **212**
  - Canadian Army Trophy (1987) 196–201, 202–203
  - deployment 4–5, 8, 184, **191**, **193**, **194**, **204**, 206, **207**, 208–225, 232–233
  - design and development 8, 174–181, 201–204, 206
  - exports **202**
  - Fire-Control Systems (FCS) 186–192
  - insignia **179**, **185**, **189**, **191**, **213**, **214**, **220**
  - paint schemes **185**, **197**, **215**
  - technical description 182–185
  - variants 192–195, **196**
- Challenger 2 tanks 7
  - armament **229**, 244–247
  - armour **241**, 249, 261
  - deployment **239**, **255**, 259–290
  - design and development 9, 204–206, 227–243
  - exports **203**, 256–259
  - Fire-Control Systems (FCS) 188, 190, **228**
  - insignia **7**, **233**, **239**, **251**, **267**, **269**, **271**, **275**, **281**
  - paint schemes **233**, **238**, **241**, **247**, **267**, **271**, **272**
  - special purpose variants 252–259, **260**
  - technical description 244–251
- Chawinda, Battle of (1965) 82–83
- Chieftain tanks **5**, 6, **9**, 115
  - armament 4, 129–132, 136–137, **138**, **139**, **145**, 172, 173
  - armour 134, **150**, 166
  - Chariot 152–155
  - deployment **137**, 156–162, **163**, 165, 166, **167**
  - design and development 128–142, 176–178
  - exports 150, **154**, **155**, **156**, **157**, 160, **173**, 177–178, 256
  - Fire-Control Systems (FCS) 186–187, 188, 191–192
  - insignia **131**, **140**, **145**, **149**, **155**, **163**
  - paint schemes **131**, **140**, **145**, **148**, **151**
  - special purpose variants **137**, 162–173
  - technical description 142–151
  - tracks **152**
- Chobham armour 7, 8, **54**, 125, **125**, **156**, 166, 175, **209**, **212**, 249, 261
- Churchill tanks 21
- Clark, Alan 237
- Clarke, Trooper David 269
- Clarker, Lieutenant Sam 268
- Comet tanks 22
- communications 28, 146, **147**
- Computerized Sighting System (CSS) 183, 191–192
- Conqueror heavy tanks **24**, 25–26, **31**, 34–41, 43–44, 133
- Cordingley, Brigadier Patrick 215
- Coward, Colonel James 277–278
- Cromwell tanks 21, 22, 31, 67
- Cruiser tanks 19, **19**
- CSS (Computerized Sighting System) 183, 191–192

Dale, Corporal Joe 268
'Danny Boy' engagement (2004) 280
Dayan, Moshe 96–97, 98, 99
de Silva, Captain Ran 276
Denaro, Lieutenant Colonel Arthur 216
deployment
  Centurion tanks 7, 10–19, 46, **51, 52, 53,** 54, **54,** 56, 57–61, 66–113
  Challenger 1 tanks 4–5, 8, 184, **191, 193, 194, 204,** 206, **207,** 208–225, 232–233
  Challenger 2 tanks **239, 255,** 259–290
  Chieftain tanks **137,** 156–162, **163,** 165, 166, **167**
  Vickers Battle tanks 117, 118
design and development
  Centurion tanks 19–26, **20, 22, 23, 25**
  Challenger 1 tanks 8, 174–181, 201–204, 206
  Challenger 2 tanks 9, 204–206, 227–243
  Chieftain tanks 128–142, 176–178
  Vickers Battle tanks 115–117, 118–124, 125–127
Dorchester armour **241,** 249, 261
Driver, Corporal 270

ECM (Electronic Counter Measures) **241**
Eitan, Major General Rafael 'Raful' 98, 102, 108, 110, 113
Eldar, Lieutenant Yos 107, 111, 112, 113
Electronic Counter Measures (ECM) **241**
engines
  General Motors Detroit Diesel 121, 125
  Leyland L60: 116, 118, 135, **136, 137,** 138–139, 140–142, **141, 147, 156**
  Meteor 22, 29–30, 37
  Morris 30
  MTU 873 Ka-501: 127
  Perkins Engines Condor V12 TCA 184, 251, **252**
  Perkins Engines Condor V12 TCE 123
  Rolls-Royce 90-degree V8: 133
  Rolls-Royce Condor CV12 TCA 8
  Rolls-Royce M120: **37**
  Teledyne Continental AVDS-1790--2A **46,** 58
ERA (Explosive Reactive Armour) 59–61, **209,** 249
Erez, Lieutenant Colonel Oded 100, 105, 107
Eshkol, Prime Minister Levi 153
evolution, Centurion tanks 44–50
Exercise *Saif Sareea II* (2001) 260–263
Explosive Reactive Armour (ERA) 59–61, **209,** 249
exports
  Centurion tanks 7, **42,** 44–47, **55**
  Challenger 1 tanks **202**
  Challenger 2 tanks **203,** 256–259
  Chieftain tanks 150, **154, 155, 156, 157,** 160, **173,** 177–178, 256
  Vickers Battle tanks 114, 115, **115,** 116–118, **123,** 124–125

Falklands War (1982) 56
FCS (Fire-Control Systems) 186–192
Fearless, HMS **53,** 56
Field Human-Intelligence Team (FHT) 271
Fighting in Built Up Areas (FIBUA) **232**
Fighting Vehicle Gun Control Equipment (FVGCE) 147
Frazer, Trooper William 274
Future Engineer Tank (FET) 252
Future Main Battle Tank (FMBT) 175

Garrett, Corporal James 274
GCE (Gun Control Equipment) 187–188, 192
General Motors Detroit Diesel engines 121, 125
Gibbon, Lieutenant Colonel T. 79
Global Positioning System (GPS) 212, 214, **217,** 247, **269**
Golan Heights, defence of 94–113
Green, Captain Tim **78**
Greengold, Lieutenant Zvi 'Zvika' 108

grenade launchers 65
Gulf War 1 (1990-91) 4–5, 8, **51**, 54, **54**, 56, **137**, **163**, 165, 166, **167**, 184, **193**, 208–225, 232–233, 261
Gulf War 2 (2003-11) 56, **56**, 263–290
Gun Control Equipment (GCE) 187–188, 192

Happy Valley, Battle of (1951) 66–67
Harrison, Major Giles 270–273
Harvey, Dr Gilbert 175
heating systems 238
Heseltine, Michael 235, 236–237
High-Explosive Anti-Tank (HEAT) ammunition 32, 59, 61, 116, **122**, 129, 174, 175
High-Explosive Squash Head (HESH) ammunition **7**, 8, 34, **130**, 183, **264**
High-Velocity Amour-Piercing (HVAP) ammunition 129
Hod, Major General Mordechai 'Motti' 105, 108
Hofi, Major General Yitzhak 'Khaka' 97, 102, 105, 108
Hook, Second Battle of the (1952) 10–18, **69**
Horne, Captain 271
Hungarian Uprising (1956) 47
Hurd, Douglas 235, 236
Hussein, Saddam 157, 160, 260
Huth, Major Henry 69–70
HVAP (High-Velocity Amour-Piercing) ammunition 129

IED (Improvised Explosive Device) **287**
Imjin River, Battle of (1951) 10, **66**, 68–70
Improved Fire Control Systems (IFCS) **117**, 126, **145**, **147**, 191–192
Improvised Explosive Device (IED) **287**
Indo-Pakistan War (1965) 57, 80–84, **81**, **82**, **83**, 117
Indo-Pakistan War (1971) **84**, 118
infrared (IR) equipment 49, 107, 134, 146, 190
insignia
  Centurion tanks **23**, **29**, **43**, **47**, **51**, **77**, **81**, **85**, **109**
  Challenger 1 tanks **179**, **185**, **189**, **191**, **213**, **214**, **220**
  Challenger 2 tanks **7**, **233**, **239**, **251**, **267**, **269**, **271**, **275**, **281**
  Chieftain tanks **131**, **140**, **145**, **149**, **155**, **163**
  Vickers Battle tanks 117
Intrepid, HMS 56
IR (infrared) equipment 49, 107, 134, 146, 190
Iranian Revolution (1979) 150
Iran-Iraq War (1980-88) 156–160, **161**
IS-3 tanks 25, 30–31, **31**, 43–44
Israeli Defense Forces (IDF) 44–47, 58–61, 88–113, 152–155

Joly, Major John 76
Julien, Trooper 269

Kahalani, Lieutenant Colonel Avigdor 107, 109, 112
Khorramshahr, Battle of (1980) 157–158
King, Tom 235, 236
King's Royal Hussars **194**, **208**, **210**, 211–225, **213**, **216**, **231**, **232**, **249**, **287**
Korean War (1950-53) 10–18, **51**, 66–74
Kosovo (2000) **239**, 259–260
Kursk, Battle of (1943) 19
Kuwait (1990) 160–162, **207**

L3A2 Browning machine guns **25**
L11A5 rifled guns 8
L27A1 depleted uranium rounds 245
L60 engines *see* Leyland L60 engines
laser rangefinders 190–191
Leach, Lieutenant H. **78**
Lebanon (2002) 61
Lebanon (2006) **60**
Leopard 1 tanks 6, 138, 152–153, 177
Leopard 2 tanks 6, 7, 126, 127, 177, 205, 230, 234
Levene, Sir Peter 229
Lewis, Trooper Taffy 15, 16, 17, **17**

Leyland L60 engines 116, 118, 135, **136, 137,** 138–139, 140–142, **141,** **147**, **156**
linkages 189–190

M103 heavy tanks 25, 32, **33**
Macawai, Trooper Ilivia 'Mac' 273
Magnetic Influence Mine Induction Coils (MIMICs) **54**
Major, Prime Minister John 235, 236, 237
Marks, Trooper Ron 14–15, 17, 18, **18**
Matilda Infantry Mark II tanks 19
McClintock, John 38–41
Meteor petrol engines 22, 29–30, 37
Military Operations in Urban Terrain (MOUT) **232**
MIMICs (Magnetic Influence Mine Induction Coils) **54**
Morgan, Corporal John 273, 274
Morris engines 30
MTU 873 Ka-501 engines 127
Muzzle Reference System (MRS) 187

Nafshi, Lieutenant Colonel Yair 99, 100–101
Nasser, Colonel Gamil Abdul 74
NATO (North Atlantic Treaty Organization) 44, 47, 66, 129, 134, 157, **185, 191,** 200, 208, 259, 263
Newton, Corporal 280
Northern Ireland **53**
Nunn, Sergeant Bob 16–17

OAP (Operational Armour Packs) 249
October War (1973) **57, 90,** 155, 176
O'Fee, Corporal Mark 288
Offord, Colonel Eric 83–84
Olifant, the 62–65
Operation *Adulate* (1967) 153
Operation *Agricola* (2000) **239,** 259–260
Operation *Armadillo's Delight* (1964) **47**
Operation *Charge of the Knights* (2008) 286–290
Operation *Commando* (1951) 71–72
Operation *Cray* (1992) **247**
Operation *Danube* (1968) 44
Operation *Desert Sabre* (1991) **54,** 166, 208–225, 261
Operation *Granby* (1991) 8, **52, 54, 163, 167,** 208–225, 232–233
Operation *Hamkari* (2010) **260**
Operation *Hammersmith* (2004) 280–284
Operation *Hermit Park* (1971) 88
Operation *Howeizeh* (1981) 158–159
Operation *James* (2003) 273–276
Operation *Jehu 5* (1952) 72–74
Operation *Litani River* (1978) **97**
Operation *Moshtarak* (2010) **255**
Operation *Motorman* (1973) **53**
Operation *Musketeer* (1956) **51,** 57, 74–80, 176
Operation *Nassr* (1981) 158–159
Operation *Overlord* (1944) 21
Operation *Peace for Galilee* (1982) **106**
Operation *Resolute* (1996) **182, 191**
Operation *Savannah* (1975) 63
Operation *Scotsman* (2000) **239,** 260
Operation *Sentry* (1945) 24
Operation *Tavakkol* (1981) 159
Operation *Telic* (2003-11) **56, 212,** 263–290
Operation *Trident* (1987) 118
Operation *Waterloo* (2004) 279–280
Operational Armour Packs (OAP) 249
Ormerod, Captain Johnny 216, 219–221

paint schemes
  Centurion tanks **23, 29, 43, 46, 47, 51, 53, 77, 81, 85, 86**
  Challenger 1 tanks **185, 197, 215**
  Challenger 2 tanks **233, 238, 241, 247, 267, 271, 272**
  Chieftain tanks **131, 140, 145, 148, 151**
  Vickers Battle tanks **120, 125**
Panther tanks 19–20
Parker, Corporal Rick 274
Paterson, Lieutenant Colonel David 270
Patton tanks 46, 82–84, **83,** 91, 93
Peres, Shimon 152–153
periscopes 27, 143, 183, 187, 247

Perkins Engines Condor V12 TCA 184, 251, **252**
Perkins Engines Condor V12 TCE 123
Permutter, Pete 26
Pershing tanks 31
Phillora, Battle of (1965) 82
Power, Captain Joe 266
Prague Spring (1968) 44
Prateley, Captain C. 79
Puncher, HMS 75, 79
Purbrick, Captain Tim 216–219, **217,** 221–224

Quadrant Fire Control (QFC) 189
Queen’s Dragoon Guards **205**
Queen’s Own Hussars **147, 148**
Queen’s Royal Hussars **182, 191, 205, 206, 247**
Queen’s Royal Irish Hussars **131,** 196, 208–225, **214, 217, 220, 223, 225**
Queen’s Royal Lancers **180, 189,** 215–225, 262–263, **263,** 264–290, **265, 271, 278, 283**

Rabin, General Yitzak **152,** 153
Radford, Lieutenant Mickey **73**
Rak, Major Zvi 103–104
rangefinders 40, 64, 65, 190–191, 247
Ravager, HMS 75, 79
Reliability Growth Trial (RGT) 257
Richards, Sergeant Chris 288–290, **289**
roadwheels **242,** 251
Roberts, Sergeant Steven ‘TC’ 266
Rolls-Royce 90-degree V8 engines 133
Rolls-Royce Condor CV12 TCA engines 8
Rolls-Royce M120 engines **37**
Ronis, Captain Avi 101
Rose, Lieutenant Colonel David 10
Royal Dragoon Guards **135, 201, 243, 261,** 262–263, **281, 282, 284, 285, 288**
Royal Electrical and Mechanical Engineers **193**
Royal Engineers **53,** 53–54, **54,** 208
Royal Hussars **179,** 181, 196, 198–201
Royal Regiment of Fusiliers **210,** 211–225, 265, **265**
Royal Scots Dragoon Guards 4–5, **5, 145, 169,** 196, **204, 207,** 208–225, **210,** 211–225, **218, 225, 233, 237, 239,** 240, **242,** 242–243, **243,** 259–260, 264–290, **272, 274, 275, 285**

Sagger anti-tank missiles 111
Salerno, HMS 75, 79
Shadmi, Colonel Yissacher ‘Iska’ 93–94
Sherman tanks 4, 10, 19, 20–21, 117, 131
Simons, Corporal Justin 274
Sino-Indian border conflict (1962) 117
Six Day War (1967) 46, 58, 92–94, 95
South African Army 62–65
Southam, Staff Sergeant John 270, **271**
Stalin, Josef 66
Stillbrew passive armour **150**
Strauss, Hans Josef 153
Suez campaign (1956) **51,** 57, 74–80, 176
Suvla, HMS 75
Swann, Major David 217
Swinton, Lieutenant Colonel William 286
Syria (1970) 57

T-10M tanks 33–34, **34**
T-26 tanks 114
T-54 tanks 92, 93, 96, 101, 104, 105, 109, 110, 117
T-55 tanks 93, 96, 101, 104, 105, 107, 109, 110, 117, 157, 276
T-62 tanks 7, 110, 112, 113, 157, 159
T-72 tanks 159, 160, 212
Tal, General Israel 45, 93, **152,** 153, 154–155
Tank Laser Sight (TLS) 147
tanks, British *see also* Centurion tanks; Challenger 2 tanks; Challenger tanks; Chieftain tanks; Vickers Battle tanks
  Churchill tanks 21
  Comet tanks 22
  Conqueror heavy tanks **24,** 25–26, **31,** 34–41, 43–44, 133
  Cromwell tanks 21, 22, 31, 67
  Cruiser tanks 19, **19**

  - Matilda Infantry Mark II tanks 19
  - Valentine Infantry Mark III tanks **19**
- tanks, French
  - AMX Leclerc tanks 231
  - AMX-30 tanks 152–153
  - AMX-50 tanks **32,** 32–33
- tanks, German
  - Leopard 1 tanks 6, 138, 152–153, 177
  - Leopard 2 tanks 6, 7, 126, 127, 177, 205–206, 230, 234
  - Panther tanks 19–20
  - Tiger tanks 20
- tanks, Russian
  - IS-3 tanks 25, 30–31, **31,** 43–44
  - T-10M tanks 33–34, **34**
  - T-26 tanks 114
  - T-54 tanks 92, 93, 96, 101, 104, 105, 109, 110, 117
  - T-55 tanks 93, 96, 101, 104, 105, 107, 109, 110, 117, 157, 276
  - T-62 tanks 7, 110, 112, 113, 157, 159
  - T-72 tanks 159, 160, 212
- tanks, US
  - Abrams tanks 175, 184, 205, 228
  - Chaffee light tanks 31
  - M103 heavy tanks 25, 32, **33**
  - Patton tanks 46, 82–84, **83,** 91, 93
  - Pershing tanks 31
  - Sherman tanks 4, 10, 19, 20–21, 117, 131
- technical description
  - Centurion tanks 26–30, **27**
  - Challenger 1 tanks 182–185
  - Challenger 2 tanks 244–251
  - Chieftain tanks 142–151
- Teledyne Continental AVDS-1790--2A engines **46,** 58
- Ten Year Rule, the 114
- Thatcher, Prime Minister Margaret **179**
- Thermal Imaging (TI) 8, **64, 117,** 190, **229, 241,** 247
- Thermal Observation and Gunnery System (TOGS) 8, 183–184, 190, 247
- Tiger tanks 20
- TLS (Tank Laser Sight) 147
- TOGS (Thermal Observation and Gunnery System) 8, 183–184, 190, 247
- Topping, Sergeant Andy 266, **267,** 268, **268**
- tracks **152, 242,** 251
- turrets 22, 24, 27, **27,** 37, **49,** 65, **122,** 125–126, 134, 138, **172**
- Twiddy, Lance Corporal 269

- United Nations (UN) 66, 208, 260
- upgrades, Centurion tanks 57–65, 88–89

- Valentine Infantry Mark III tanks **19**
- Valley of Tears, Battle of (1973) **90,** 111–113, **112**
- variants
  - Centurion tanks 50–57
  - Challenger 1 tanks 192–195, **196**
  - Challenger 2 tanks 252–259, **260**
  - Chieftain tanks **137,** 162–173
  - Vickers Battle tanks 115, 117, **119,** 122–123
- Vehicle Check Points (VCP) 260, 266
- Vickers Battle tanks
  - A1E1 Independent Heavy Tanks 114
  - A6 Medium Mark III 114
  - armament 114, **117,** 119, **119,** 120, 122, **122,** 124, 125, 126
  - armour 125, **125**
  - background 114–115
  - Cruiser tanks 114–115
  - deployment 117, 118
  - exports 114, 115, **115,** 116–118, **123,** 124–125
  - insignia 117
  - Light Tank Mark IIB **116**
  - Medium Tank Mark I 114
  - Medium Tank Mark II 114
  - paint schemes **120, 125**
  - Six-Ton tanks 114, **115**
  - special purpose variants 115, 117, **119,** 122–123
  - Valentine Infantry Tank Mark III 115
  - Vickers MBT Mark 1 118–121, 124, **124,** 160
  - Vickers MBT Mark 2 **120,** 121

  Vickers MBT Mark 3 121–123, 124, 125
  Vickers MBT Mark 3 (Improved) 123–124
  Vickers MBT Mark 4 Valiant 125–126
  Vickers MBT Mark 7 126–127
  Vijayanta 115–118, **119**
Vietnam War (1955-75) **55,** 57, **85,** 85–88
Vincent, General Sir Richard 227

Walker, Julian 7
Walters, Captain Bob **16**
War of Attrition (1969-70) 95
Warsaw Pact 129, 157, **185**
Water War, The (1964-67) 91–92
Weizman, Ezer 153
Williamson, Lance Corporal Peter 12, 15, 16, 17
Woodward, Mr. C.O. 114
World War I (1914-18) 4, 9, **185, 293**
World War II (1939-45) 4, **19,** 19–23, 114–115, **115**
Wyatt, Lieutenant Will 219

Yakir, Lieutenant Yoav 101, 104
Yom Kippur War (1973) 7, 58–59, 99–113
Younger, George 228

Zeira, General Eli 97